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MEDICAL AND SURGICAL REPORTS

OF

THE BOSTON CITY HOSPITAL.

Seventh Series.

EDITED BY

GEORGE B. SHATTUCK, M.D., W. T. COUNCILMAN, M.D.,
AND HERBERT L. BURRELL, M.D.

BOSTON:
PUBLISHED BY THE TRUSTEES.
1896.

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PREFACE.

The seventh series of the Medical and Surgical Reports of The Boston City Hospital is again presented as an annual publication. Some contributions, especially from the Pathological Department, which the editors would have been glad to have included, have had to be omitted for want of room. This report loses thereby some valuable material, which may find place in the next.

The Hospital continues to grow, and now contains 706 beds. There has been added a whole new department, with 206 beds for infectious diseases, — diphtheria and scarlet fever, — which is now in active operation. Details of the work in this department, it is hoped, may be presented in the next series of these reports. There is also a new building for surgical wards now nearly ready for occupancy.

The new pathological laboratory, one of the very best in all respects in this country, is now occupied and being used.

The plate which appeared in the last volume, preceding the title-page, has been omitted from this, as it no longer represents the Hospital as it exists to-day. The editors have again been disappointed in their expectation of including in this report an account of the internal arrangements of the new buildings, with some illustrations showing their external aspect.

Since the publication of the last volume, Dr. A. M. Sumner has resigned from the Medical Staff.

The Editors.

April, 1896.

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I.

SURGICAL MORALS.

By David W. Cheever, M.D.

An educated layman once said to the writer, "If you undertake an operation and do your part, and anything goes wrong, why should you feel any more responsibility than the carpenter, who does his job and has no more anxiety about it?" Going a step farther, we have the uneducated public, who consider the surgeon a licensed cutter, without care or conscience. That this cannot be the enviable state of mind of the educated surgeon will be familiar to any one of us who exchanges, in his position, the calmness of an assistant for the anxiety of a principal in a capital operation. "Would that this callousness did more generally prevail," is often the wish of the overworked and too sensitive surgeon. "Bad for humanity, but good for us," would be the verdict of all our brethren. This false estimate of the surgeon's indifference may be general, but is almost never true. The architect who swings a great stone noiselessly and safely into its place, the captain on the bridge of a coast-nearing steamer, the locomotive engineer who runs the express, — these are comparable examples of the alertness, the vigilance, the ever-present and wearing anxiety of the surgeon. Watchful of the field of danger beneath his knife, he also is burdened with the whole weight of the chances of life or death to his patient, from his constitutional condition. How much can he stand? and how long can he stand it? These questions are ever present. Is it safer to stop or to go on? are problems as familiar and as unpleasant to the operator's mind as the diagnosis and the decision as to whether he shall begin at all. In the present feverish condition of operative surgery, it may be prudent to ask ourselves, first, what is the object of an operation; second,

how should we regulate our conduct in unforeseen contingencies? We may, perhaps, condense the problem into the following simple questions:

When to operate?

When not to operate?

When to stop?

When not to stop?

It has been a mooted question whether the practice of vivisection, even more than ordinary dissection, may not thicken the surgeon's skin and dull his sensibilities. And, again, it can hardly be a disputable assertion that antisepsis and its immunity have rendered exploratory operations, based on a halting diagnosis, more frequent and safer, if not more desirable, than in the past. And yet, in dealing with the great question of the life or death of a human being, what operator of any sensibility can put aside the saying of the Roman philosopher: "Homo sum: Humani nihil a me alienum puto."

What is more distressing than a death upon the table? What injures our art more than a fatal operation, which pathology proves to have been useless, or even more, unnecessary?

When to operate?

If we confine our selection of cases to those which clearly come under the cardinal rule for operation, namely, to relieve suffering, or to prolong life, or both, we shall have little difficulty in the choice. Is life imperilled? should be the first question. Can we probably relieve the suffering? the second. But when asked to operate, shall we accept only good risks, and refuse the doubtful or hopeless cases?

When *not* to operate?

When to decline is the real difficulty of decision to be met. Do not operate without the full consent of the patient and friends, if possible. See that some responsible party understands what operation you intend to do, and what may be reasonably expected from it.

Do not operate in a state of shock, unless hæmorrhage, apnœa, or obstruction of the bowels, as in hernia, is going on. If you have time, consider fully the systemic condition of the patient — the integrity of the heart, arteries,

kidneys. In a case of no emergency, the age and prospect of life of the patient are to be taken into account. A person of 70 years, having an expectation of life of five or six years, is in a very different category from a youth of 16, who has a reasonable expectation of life of 60 years. You would take a risk with the latter which you would not with the former.

Do not operate in glandular infiltrations so extensive as to preclude perfect removal. Do not operate where you cannot remove the whole disease, as in a tuberculous organ, if you excise a part; or a sarcoma of the antrum where you cannot extirpate the sphenoid cells. To these rules we would make two important exceptions:

First. To relieve agonizing pain operate on any slight chance: for unless the suffering can be palliated, the patient had better die than live.

Second. In a "forlorn hope," so called, after you have fairly stated the risk, the patient is entitled to an operation if he wishes, and if he takes the responsibility; but even here you must limit yourself to cases where there is a single, or some, chance of success.

During an operation when must we stop? When the patient fails? Not always. That failure may be due to ether, or even to simple nausea. Pause, stimulate, consider maturely, before abandoning your task.

Stop when you have reached the end of all you can take out, in a malignant tumor, for instance.

Stop in an operation in the abdominal cavity when a glance or touch reveals that the tumor is not removable, and has grown into vital parts. Do not explore it farther, or you will get where you cannot stop.

Stop in an operation on the surface of the body when stopping will not imperil life as much as going on; in syncope, with a pulse at 180, with sighing respiration, with a colliquative sweat.

When must you *not* stop? When the patient surely will die if you do. Keep on as long as he breathes. It is his only chance. What terrible contingency is this? Such is an operation which has so far displaced and broken up a soft internal tumor as to render death from bleeding or

sepsis sure, if any is left. An oozing hæmorrhage: a difficult tracheotomy: a crushed skull with a pulse of 40, and a Cheyne-Stokes respiration: having trephined, we cannot stop until compression is removed and bleeding checked. Extravasation of urine, and a bladder to be drained: if the patient dies in the process, we must drain the bladder.

Not doing all these things, the patient necessarily dies: his only chance lies in their being done.

Surrounded with these terrible chances, the surgeon, like the executioner, raises or depresses his thumb, and the patient lives or dies. Surely there is no responsibility like this!

Such imminence of peril should teach us, first, to be over-careful and wary about getting in so deep that we cannot withdraw, or about meddling with what had better be left alone. Second, not to imperil life to cover our mistakes: we all make them, and the busy surgeon more than others, by a simple arithmetical law. Third, in self-defence to withdraw from an operation, or a case, at once if our advice is not followed. To bear the responsibility, we must be absolute masters.

II.

A CASE OF UNIQUE LACERATION OF THE CERVIX.

By Edward Jacob Forster, M.D.

Lizzie A. H., born in Germany, 28 years of age, married, mother of two children. Twice entered the hospital, the first time in the spring of 1890. The diagnosis at that time was: "Laceration of the perineum extending to sphincter, cervix ante-flexed, uterus freely movable."

The attending physician did a very careful operation for the repair of the lacerated perineum, and the result is thus recorded: "Examination shows a good perineal body, union firm throughout." Five days later the record reads: "Less congestion and redness on posterior lip of cervix."

Again, in five days, we find that "Small portions of posterior lip of cervix snipped off for miscroscopical examination." The result of this examination showed "the mass to consist of retention cysts."

After a vaginal examination it is reported that "On posterior lip of cervix is a ragged surface covered with exuberant granulations." To these were applied at different times fuming nitric acid, nitrate of silver, and the thermo-cautery, with the result that the "granulations were more healthy in character," and soon "nearly closed in."

Four days before leaving the hospital it is recorded that "A sinus still extends from posterior wall into cervical canal."

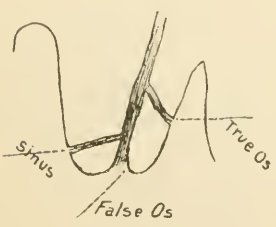
After a stay of sixty-four days in the hospital, her "general condition improving," she desired to go home, and departed, on her own request and against advice.

This account of her first hospital experience is given to show that the true condition of the injury she had sustained during a confinement was not then recognized.

Some months later I saw the patient for the first time, when she consulted me for pains in her back and bowels, distress and flatulency after food, associated with constipation and "womb trouble." Examination showed a perineum which bore evidence of a previous operation and an apparently lacerated cervix.

The perineal body was practically nil, although there was good union of the outer integument. I recommended an operation on the cervix and another on the perineum. She entered my service at the Boston City Hospital in November, 1890.

A careful vaginal examination (in Sim's position) showed the apparent laceration to be an injury to the cervix, bearing the same relation to the os that the rare injury to the perineum, when it is perforated by the passage of the child's head, bears to the vulva. The os, to all appearance a virgin one, was found well up on the anterior wall of the cervix, while where the os should have been were two openings, the larger of which communicated directly with the uterine cavity. The lips of this opening were eroded, and in the same condition as an ordinary untreated lacerated cervix.



The smaller opening was a small sinus communicating directly with the larger opening, and was probably the sinus noticed in the hospital record quoted.

A sound passed as readily to the fundus through the larger opening as when passed directly through the os.

My diagnosis was: A laceration occurring during labor of the posterior wall of the cervix, through which a child had passed, caused by a rigid and undilated os, with perhaps greater attenuation than usual of the posterior wall: an accident which, so far as I can learn, has not before been placed on record.

Several of my colleagues saw the case, and agreed with me as to the character of the injury. Whether they agreed with me as to the cause, I do not remember.

To close this false opening, I operated three times before

succeeding. My mode of procedure I now think faulty. I operated in the same manner as for a vesico-vaginal fistula, whereas it would have been much better, I now believe, had I slit the cervix at the time at the true os, making one opening, and then operating as in an ordinary laceration. A flap-splitting operation was done on the perineum.

On the 9th of February, 1891, she was discharged well, the records reporting "Result of operation good."

Inquiries were made regarding the character of the two labors, but with negative results.

Two criticisms of the correctness of my diagnosis present themselves to my mind: First, that in this case we had simply a partial double uterus, a uterine cavity with two cervical canals. The development of the uterus from the lateral coalescing of Muller's ducts would seem to meet this criticism, for one canal was directly posterior to the other, both being in the median line.

The second criticism, that we had simply a laceration of the cervix which nature had partially united, I think we can dismiss for the following reasons:

First. The comparative rarity of simple laceration of the cervix occurring in the median line, although we must here acknowledge that the chances for nature repairing a laceration are here greater than when the injury is on either side.

Second. The comparative great distance between the two canals, nearly one inch; and lastly, and most conclusively to my mind, the absence of any cicatrix, so far as the naked eye could discover; the anterior canal presenting in every particular the appearance of a normal virgin os.

III.

THREE CASES OF PSEUDO-MALIGNANT ŒDEMA.

By Abner Post, M.D.

Most of those who can recall the days when pyæmia, septicæmia, and gangrene were more frequent than they are now can separate from the mass of those unfortunate cases an occasional case which was malignant and ended fatally in a few days. The cases to which I refer were distinguished by numerous blebs, rapid swelling, and a discoloration which extended far in advance of the actual gangrene, and by the presence of gas, more or less imperfectly recognized in the tissues about the wound, and in the dark-colored fluid which flowed from it. Such cases were unusual and were examples of a not very well recognized disease which has been described under a variety of names. It is known as malignant œdema, emphysemateous gangrene, *gangrene foudroyante*, etc.

The cases often followed injuries of slight moment which promised at first sight to do well, but which in their rapidly fatal course were really due to a poison over which the surgeon had as little control as over tetanus. Occurring infrequently the disease has been looked upon simply as a rapid form of septicæmia and has hardly gained a separate place in our nosology.

It is said to have been observed twenty-nine times during the Crimean War by Sallaron.

I have not been able to identify it among the recorded fatalities of our Civil War, though I have reason to think that it may have occurred occasionally among the cases characterized as hospital gangrene. It is not mentioned by name in the medical and surgical history of the war so far as I can find.

It is thus described by Roswell Park:

"The characteristic feature of the disease is the rapidity of its spread, the septic character of the inflammatory product, and the speedy formation of gas. A dirty brownish-reddish skin, mottled with blue, whose veins are filled with stagnant blood, covers the affected areas. The underlying tissues are sodden with fluid and distended with gaseous products of decomposition so that the finger feels a fine crepitus, as is common in subcutaneous emphysema. From the wound, if there be one, flows a thin, foul-smelling secretion, which may also be expressed from the deeper layers. That the neighboring lymph spaces, vessels, and glands are actively participating in the transmission of septic products is evident from the enormous swelling which the latter present and from the general condition of the patient. The rapid elevation of temperature, with but trifling remission, remains constant until shortly before death. The tongue early become dry, cleaves to the palate, its surface covered with thick, foul fur. Consciousness is early lost, and patients become peculiarly apathetic, complaining only of pain and burning thirst. Sometimes they are delirious instead of apathetic. Coma, incontinence, frequent and superficial breathing, and dilatation of the pupil are the precursors of death which may occur in from fifteen to thirty hours.

"After death the cadaver bloats quickly and putrefaction goes on with singular rapidity. At the seat of the lesion muscles and tendons will be found macerated, the bone denuded, surrounded by a putrid fluid, and the entire region presenting a notable swelling and infiltration of the soft parts with reddish fluid and stinking gases."

In spite of our boast that septicæmia is practically banished from our wards I have to record the occurrence of three cases which I have chosen to classify under this name because the clinical symptoms were those of malignant œdema.

It must be noticed that these cases were separated by intervals of about a year and a half from each other, and that each had received an injury which exposed a broken surface to contact with the ground before they were brought to the

hospital, and it is not uninteresting to note that the accidents occurred in widely separated quarters of the city.

Case I. is the case of a school-boy 15 years of age.[1] About three o'clock, Oct. 4, 1891, while at play, he fell off Stony-brook bridge, a distance of eighteen or twenty feet, striking in the mud and shallow water at the bottom. He was brought to the hospital in an ambulance with a compound fracture of the right wrist. About one and one-half inches above the right wrist was a wound one-half by three-fourths inches over the anterior surface of the arm through which the fractured radius protruded about an inch. Bone and wound were covered with dirt. There was also a fracture of the ulna about two inches above the wrist.

Patient was etherized. Hand and arm scrubbed with sapolio and 1 to 1000 solution of corrosive. The wound and end of the bone were then carefully cleansed with sapolio and 1 to 1000 solution of corrosive sublimate. The wound was then lengthened three-fourths inch upward and one inch downward, and carefully irrigated with 1 to 1000 corrosive solution. Finger introduced, felt the roughened surface of the epiphysis in its appropriate position, and found no injury to the vessels. By forcible extension and flexion the displaced end of the radius was reduced to place and the deformity of the ulna at the seat of fracture disappeared. The wound was again washed out with 1 to 1000 corrosive carefully and closed above and below the original opening with silk sutures, the edges of the original opening were cut away, and the opening itself left open. It was dressed with a large dressing of baked gauze soaked in 1 to 3000 corrosive and immediately put in plaster, which held in position the fragments at the seat of fracture.

October 6 the record reads, "Patient slept fairly well the first night, but poorly last night. Has had a great deal of pain in arm yesterday and to-day. Temperature went up yesterday to 104 and is up again to-day. Plaster cut this P.M., gives some relief to pain. Plaster is stained through over seat of wound. Pulse 100. Plaster feels hot.

"October 7. Patient slept poorly last night: is having

[1] (Surgical Records, Vol. 203, page 180.)

much pain. Tenderness in right axilla. Plaster and dressing removed this A.M. Much discoloration and swelling of wrist, fingers, forearm. Many blebs and air-vesicles over back of hand and forearm which were punctured. Wound thoroughly irrigated and arm put to soak in hot bath of corrosive. Temperature and pulse still up. Patient is very restless and growing more or less delirious. Condition of arm evidently growing worse.

"October 7, P.M. Arm was taken out of corrosive bath and put up in charcoal dressing this P.M. Seen by Dr. Bolles again this P.M. A deep incision was made on the posterior surface on the extensor muscles of the forearm. No blood followed the incision and the flesh appeared comparatively dry. Arm was done up in baked gauze soaked in corrosive. It was thought that a line of demarcation was beginning to be established at about the upper two-thirds of the arm, near axilla.

"October 8. Temperature down this A.M., but went up again before noon. Patient still delirious and very restless. Gangrenous process has extended up and involved almost the whole of the right arm. Slight discoloration of skin noticed in right axilla and around right breast. Mother seen by Dr. Bolles and informed as to the danger of the process. Amputation advised, but rejected by mother, who says she will take the boy home rather than have him operated on. Arm soaked with solution of permanganate of potass. 1–3000.

"October 9. Patient was very restless and delirious through the night and suffered a good deal of pain. Gangrenous process has rapidly extended and discoloration noticed on whole of right shoulder and has even extended across to left breast and shoulder. Patient is rapidly failing and losing strength. Pulse and temperature have gone way up. Operation out of the question this A.M., though the mother is now anxious to have it done. Patient failed rapidly during the day and died this P.M."

No autopsy permitted. An attempt at bacteriological study was made, but no definite results were reached. In fact, bacteriology cannot be said to have existed as a dominant factor at the hospital at that time.

It was something of a shock to find that in spite of the most careful antiseptic precautions one of the most unpleasant forms of septic infection had taken place.

It was evident that we were face to face with something of an unusual nature. That the infection was one that in some way set at naught antiseptic precautions was, I believe, the opinion of those of the surgical staff who saw it. The description which I have copied from the notes was written without any suggestion of the disease known as malignant œdema, and still the account accords most wonderfully with the description given by Park which has already been quoted.

Case II.—On May 26, 1893, W. R., a roofer, 27 years old, made an attempt at suicide by cutting his left arm, and lay without assistance for two hours in an unpaved cellar.

After the injury he crawled about fifteen feet in the cellar over dirt and old bits of masonry. He was first seen at his own home by a doctor, who secured the bleeding vessels and attempted to carry out surgical antisepsis so far as the opportunities permitted. The wound was drawn together by catgut sutures, and dressed with iodoform.

He reached the hospital between six or seven hours after the suicidal attempt. Apparently the patient's mental condition was not normal. He was said to be suffering from the effects of sunstroke. On admission patient had a weak and intermittent pulse, absent in the wrist, the injured arm. Skin and mucous membranes pale, surface cold and covered with sweat. Extremities cold. On the left arm one inch below the flexure of the elbow on the anterior and upper surface was a clean-cut wound which subsequent examination showed to be four inches long, at right angles to the long axis of the arm and extending nearly if not quite to the bone. The joint was not exposed, but the main vessels and nerves were severed. Arm below blanched, not cyanotic. The foot of the bed was raised. Heat applied and stimulants given subcutaneously. The patient improved in condition, but evidently was not in shape for any long or serious procedure. However, ether was administered and the sutures removed, and

the wound was scrubbed with corrosive. It was not deemed advisable to make any attempt at that time to unite with any care the severed nerves. To save the patient's life and avoid suppuration was, however, expected. The arm was done up with aseptic gauze, flexed a little beyond a right angle, and secured by a light plaster of Paris bandage.

The operation was done with the greatest possible rapidity and with the least possible amount of ether. The patient made a good recovery from ether and went to the ward in good condition.

"May 27. Passed a good night, but was talkative at times. This morning was more talkative and became a little delirious. Would not let attendants take pulse or temperature.

"10 A.M. Hand began to turn purple. Plaster was cut in spite of opposition of patient, which was sufficient to require the services of several ward masters. Patient became so delirious he was sent to Ward K. There Dr. Post took down the dressing and removed a single stitch at either end of the wound and irrigated and detected peculiar odor and slight purulent discharge. Aseptic dressing reapplied without plaster or splints.

"12.30 P.M. House-officer called. Patient delirious, had been out of bed and about the room; incontinence of urine and fæces. Dressings soaked through with blood. Arm loosely bound to a right-angled tin splint, patient resisting. Restraint applied. Hand still grew cyanotic and splint was removed. Patient was then in critical condition. Pulse more rapid, weaker, intermittent. Delirium has increased. Refused nourishment and treatment repeatedly.

"8 P.M. Had to have camisole. Arm and hand still cyanotic in spite of removal of splint and part of dressing.

"11 P.M. Pulse very feeble and intermittent. Patient became weaker and weaker, more delirious, incontinence of urine and fæces continued, and patient finally died at 2.10 A.M., the whole case having lasted less than forty-eight hours from the infliction of the wound to the fatal termination."

Autopsy May 28. Autopsy Records, Vol. 16, page 36.

AUTOPSY DIAGNOSIS, SEPTICÆMIA.

Autopsy by Dr. Dwight eight hours after death. Body well developed and nourished. Warm. Rigor mortis present. Left arm, shoulder, and left chest swollen, discolored, and large amount of emphysema extending into right clavicular region. Several large blebs on flexor surface of left arm. About two inches below bend of elbow incised wound five inches long. Edges separated by swelling from within, with protrusions from its lower end of blood clots and muscular substance. On pressure anywhere in vicinity large amount of frothy fluid can be expressed. Foul odor and discharge.

Head. — No sign of injury. Skull normal thickness. Meninges adherent to skull over both frontal and right parietal regions. Meninges injected. Brain substance rather soft, and vessels injected, otherwise normal.

Chest. — Each pleural cavity contained small amount of reddish fluid, emphysema of precordial tissues.

Lungs. — Entirely free, inflated, emphysematous, considerable amount of watery œdema.

Heart. — Pericardium contains about one ounce of clear fluid. Heart muscles somewhat soft and opaque. Size normal. Valves normal. Right side of heart and both auricles contain large amount of clotted blood with considerable emphysema.

Liver. — Normal in size, soft, and somewhat injected.

Spleen. — Considerably enlarged, dark red, soft, and pulpy.

Kidneys. — Normal size, considerably injected. Capsule not adherent. Adrenal glands enlarged, firm, and red.

Bladder. — Contained considerable quantity of clear urine.

Mesenteric and post-peritoneal glands considerably enlarged, soft, and red.

Intestines. — Large, has large amount of soft unformed yellow fæcal matter. Small intestines, about a foot and a half above ilio-cæcal valve was somewhat injected, and in this region the Peyers patches and follicles were moderately enlarged.

Aorta and great vessels normal.

Cultures were taken from urine, heart, chest walls, etc.

DIAGNOSIS.

Infected wound of arm.
Septicæmia.
Acute congestion of liver and kidneys and spleen.
Enlargement and congestion of mesenteric and post-peritoneal glands.
Granular degeneration of heart.
Congestion and œdema of lungs.
Chronic adhesive meningitis.

The earth from the spot where the suicide lay was obtained by Dr. George L. West, who at that time was substituting as surgical junior, who found that the so-called cellar was simply an unventilated air-space between the earth and the floor of a basement; that the man had crawled along to a space so small that it was difficult to follow him, but his course could still be marked by the blood. The earth was obtained from this place as near the spot where the suicide was found as Dr. West could reach by crawling on hands and knees.

In regard to the bacteriological examination, Dr. Dwight wrote me as follows:

CASE OF W. R.

In the absence of the regular pathologist I attempted to demonstrate the organisms present in this case. Cultures from the liver, lungs, and urine were negative. Sections of muscular tissue from the edges of the wound in arm showed numerous staphylococci and large bacilli in chains of three or four elements. Cultures from wound, spleen, and heart's blood showed staphylococcus pyoyenes aureus, and the above bacillus in great numbers. In cultures from the chest wall, the aureus was absent, but the bacillus present resembled in appearance and biological characteristics the bacillus of malignant œdema. This was not the bacillus œdematis maligni because of its failure to liquefy gelatine, and its not being strictly anærobic. Its growth, spore, and gas formation were very rapid, and in boullion, under hydrogen, the chains were much larger, often containing eight or ten elements. In earth from the cellar where the injury was inflicted, a similiar organism was demonstrated in great numbers. This would seem to be a mixed infection, in which, if the bacillus reported was not the direct cause of death, it certainly influenced materially the progress of the infection.

EDWIN W. DWIGHT, M.D.

The cultures were seen by Dr. Mallory who confirmed Dr. Dwight's description.

This case presented in a striking manner the characteristics of malignant œdema. The autopsy seemed to confirm that diagnosis. In previous years that would have been enough. It was, I must confess, quite a disappointment to find that the bacteriological examination failed to disclose the existence of the bacillus of malignant œdema.

The third case occurred a year and a half later, when I was acting temporarily for Dr. Gavin.

Case III. — Nov. 8, 1894. P. H., 35, a teamster, was thrown from his wagon and suffered a compound fracture of his right leg. After the accident he crawled about a hundred yards along the road and lay in the cold and dirt for some time before he was brought to the hospital in a police ambulance. At the hospital he was found to have two wounds, one over the tibia, the other over the fibula communicating with a single fracture in each bone, the tibia projecting from the wound. The patient had cold extremities with rapid and weak pulse.

On Dr. Post's arrival he was etherized and the wound cleansed. The original wound was enlarged. Each end of the bones was turned out of the wound and washed and scrubbed. Sapolio and corrosive sublimate 1–3000 were freely used. Small particles of bone and lacerated tissues were removed. The wound was partially brought together. A baked gauze dressing applied and the whole secured by a plaster of Paris bandage. The actual work was done by Dr. West, at that time house surgeon. It was done just as thoroughly as we knew how to do it, — more thoroughly, probably, than if either of us had worked alone.

During the first night there was considerable staining of the plaster, caused perhaps by the extreme restlessness of the patient. There was indefinite pain and discomfort. The next morning the plaster was split and spread open without disturbing the antiseptic dressing within, because of the general condition which we could not explain, and not because of any objective sign of compression. On the 10th the stains on the plaster had ceased to spread. The patient complained of pain in the back and was with difficulty kept quiet. He was constantly trying to get out of bed and picking at the dressing. The patient was thought to be alcoholic. Temperature was slightly elevated.

November 11. Patient picked out much of the dressing through the cut in the plaster bandage last night. Temperature 103. It was necessary to remove the plaster and apply a fresh dressing. The wound was found in good condition, slight sloughing of the edges of the wound, but no pus, and nothing to explain the general condition. The

wound was irrigated and baked gauze reapplied with a new bandage.

November 13. Temperature still up. There was evidently something wrong, as shown by high temperature, rapid respiration, dry tongue, and weak pulse.

An examination of the chest failed to explain the rapid respiration. Patient continued delirious with offensive odor from wound. The outer and under aspect of leg became bluish-black and a number of blebs appeared. The bluish discoloration spread so rapidly up the thigh that its progress could be noted from hour to hour. In spite of free stimulation the patient died at 3.25 P.M., about seven days after the receipt of the injury. After death there was an abundant discharge of a thin, frothy, non-purulent fluid of an intensely disagreeable odor from the wound.

After the death, Mr. O'Brien, the surgical supervisor, who superintended the preparation for burial, came to me to ask about it.

The enormous swelling, the abundant non-purulent, but stinking fluid which contained bubbles seemed to him peculiar. He voluntarily said that he had never seen anything like it but once before, and that was in the man who committed suicide by cutting his forearm (Case No. II.) a year previous.

This case, though less acute than the second case, presented also the clinical features of malignant œdema. I was particularly anxious to investigate it, but no autopsy could be procured. Dr. Stokes, however, very kindly procured specimens from the vicinity of the original wound, which were carefully studied by Dr. James H. Wright, who reported as follows:

"Sears' Pathological Laboratory.
"Harvard Medical School, Dec. 6, 1894.

"*Report of the bacteriological examination of Dr. Post's case of peculiar cellulitis of the leg following a compound fracture, Boston City Hospital, November, 1894.*

"The material examined was the sero-purulent exudate in the deep subcutaneous tissue not far from the wound. Direct examination with the microscope showed the presence of

numerous leucocytes and numerous bacteria of two kinds, viz.: streptococci, and large numbers of a rather large bacillus, with rounded ends and one or two clear, unstained areas in its protoplasm. This bacillus was apparently present in somewhat greater numbers than the streptococci. Gelatine cultures, made after the manner of Liborius for anærobic cultivation, showed very numerous colonies throughout the medium after twenty-four hours. After forty-eight hours these colonies had increased in size, attaining a diameter of two or three millimetres. They were all alike. None of the colonies of the streptococci (which grows only feebly on gelatine) were to be made out. To the naked eye the colonies appear as hazy, cloudy, spherical spots two or three millimetres in diameter, with a faintly radiate structure and denser centre. Under the low power of the microscope the colony is seen to consist of a dense spherical centre from which radiate in all directions bizarre, contorted, elongated (sometimes cork-screw shaped) daughter colonies. These are very small and very numerous, more numerous near the central mass, but becoming progressively fewer in number toward the periphery. These small daughter colonies constitute the hazy, faintly radiate appearance noted with the naked eye.

"They may be observed with the microscope in small numbers, far beyond the microscopic limits of the colony, and having no visible connection with it. The development of the colonies in the deeper portions of the gelatine, where the oxygen of the air does not penetrate, is apparently better than on or near the surface, but growth does occur in the latter situations, so that the organism is not a strict anærobe. The gelatine is not liquefied. In sugar gelatine an abundant development of gas occurs.

"Microscopical examination shows the colonies above described to be composed of the same bacillus observed in the direct examination of the exudate.

"The bacillus is slightly above the medium size, rather plump,with rounded ends. It is somewhat variable in length, but may be said to be about three times as long as broad. In its protoplasm one or two clear spaces may be seen cen-

trally. In some cases in the centre of a rather short, plump rod a large and distinctly refracting, unstained oval body was to be seen, which was considered to be a spore.

"The bacillus is motile, occurs frequently in pairs, but not in chains, and is decolorized when subjected to the staining method of Gram.

"Inoculations of a mouse and a guinea pig subcutaneously with the material, and a guinea pig subcutaneously with the culture were made without any marked effect on the animals.

"The identity of this bacillus is uncertain. It is clearly not the so-called 'bacillus of malignant œdema.'

"JAMES H. WRIGHT, M.D."

These three cases presented clinically the history of malignant œdema. The first lasted five days. The second was very rapid, dying just about forty-eight hours after the wound. The third case was less rapid, but the abdomen was distended within the first forty-eight hours and the distention was one of the chief causes of discomfort. Too great compression, or something wrong about the dressing first suggested itself; alcoholism, insanity, pneumonia, and heart disease, because of the rapid respiration, were considered, but it was evident that we were in the presence of something unusual.

The cases deserve special study because they seem at first sight to call in question the accuracy of the antiseptic precautions of the hospital, whereas ordinary antiseptics are powerless to destroy the spores. It is only repeating facts well known to say that the spore is the most resisting object of the organic world. Chemical and physical agents that easily destroy other forms of life have very little effect upon it. Many spores require a temperature of 140 C. dry heat for several hours to destroy them. It occasionally happens that the media of a bacteriological laboratory becomes infected by a spore-bearing organism, and notwithstanding the fact that all means of sterilization are ready at hand and the objects to be disinfected are inanimate it is sometimes necessary to throw away the culture media and start afresh.

It must then be practically impossible to remove such spores from the human body when once they have gained entrance. If there is anything to be done it must be done while still the disease is confined to the spot at which it entered the body, and the only cleansing which can be of service must be mechanical.

It is conceivable that in a tissue already invaded by ordinary cocci, saprophytic or putrefactive bacteria may find conditions suitable for their growth, although such bacteria may be incapable of primarily infecting the tissues. The results produced by this mixed infection will therefore be different from those produced by an infection with the pus producers alone. There is a temptation to explain in this way the peculiar character of the inflammation in these cases, but they are exceptional cases in a series which have resulted most favorably when treated in exactly the same manner. It is the exception for compound fractures to do ill with us. I have taken great pride in showing certain compound fractures into joints because of their wonderful recoveries. It seems to me quite as just to suppose that the ordinary cocci were introduced at the time when the general condition of the patient made it necessary to inspect the original injury and when the control of the patient was very imperfect, owing to his delirium and uneasiness and the absence of ether.

It may be said that there was a singular feature in the accident of each of these three cases: In the first one the broken bone was plunged into mud of the bed of Stony brook which is practically sewage. The second case was for two hours in contact with the dirt floor of a cellar while the third lay on or crawled along the road for "some time" before he was found.

I believe early amputation, at any time after the first 24 hours, would have been too late in either of these cases.

It is common to hear the remark that purulent infection is always the fault of the surgeon, that the conscientious surgeon is liable to wrongfully accuse himself in cases of this character, and he especially lays himself open to the blame of the patient's friends.

One of the first complaints in these cases was in regard to the injured limb. There was a sense of constriction which led to the question whether the splint was too tight. I have looked at some of the recorded cases of gangrene from too tight splints, which are reported, wondering whether some of them may not have been cases of malignant œdema, but of those seen none answered the description, nor were any of them compound.

In view of the foregoing I dare to draw the following conclusions:

1. Spores may find entrance to the human body and flourish there without the power of antiseptics to kill them: they must be mechanically removed, if at all.

2. The symptoms of malignant œdema may be caused by other spore-bearing, gas-producing organisms equally well as by the bacillus now known as the bacillus of malignant œdema.

IV.

CASES ILLUSTRATING RENAL SURGERY.

By F. S. Watson, M.D.

Case 1.

Impacted Ureteral Calculus.

Exploratory laparotomy and lumbar incision. — Subsequent formation of retro-peritoneal abscess. — Recovery, with entire relief of all symptoms.

Nov. 18, 1894. Male, aged 43. Previous history. Obstinate constipation for many years. Gradual loss of appetite and flesh for three years. Three months ago, severe attack of pain in the region of the vermiform appendix. Pain was paroxysmal, and there was marked tenderness at McBurney's point. Retention of urine occurred simultaneously, requiring use of a catheter for forty-eight hours. Catheter cystitis resulted, lasting one month.

Previous to this attack there had been no bladder symptoms.

Symptoms of appendicitis ceased after two days.

Patient was discharged well six weeks after entering the hospital. Two weeks later he began to have intermittent dull pain below the tip of the eleventh rib on the right side. The pain shifts occasionally to a point midway between the eleventh rib and the crest of the ilium: it has gradually increased in severity, and at times has been very acute; bladder irritability has generally been associated with these attacks, and the urine is greatly diminished in quantity. In the intervals the quantity invariably increased. The smallest amount in twenty-four hours was eight ounces: it has been frequently as small as sixteen ounces. The largest

amount was fifty-two ounces, which was passed three days consecutively. Specific gravity ranged from 1018 to 1025. There was occasionally a slight trace of albumen, and a few hyaline casts were found in the sediment. A few red blood corpuscles were also noted, but no crystals were found at any time. At no time during an attack of pain could the amount of urine be increased by diluents or diuretics.

The patient is incapacitated by the attacks of pain, although he has not lost much flesh or strength. He has no appetite, is pale, and slightly icteric; during the attacks of pain, the bowels are obstinately constipated, in the intervals there is marked relief from this.

A provisional diagnosis of ureteral calculus was made.

Nov. 18, 1894. *Operation.* An incision three inches in length was made through the linea semi-lunaris extending upward from a point opposite to the anterior superior spine of the ilium.

Through this wound the ureter was explored. At its point of crossing the iliac vessels, a small stone was detected; while examining it, it slipped from beneath the finger, but was presently felt again.

A lumbar incision parallel with the border of the quadratus lumborum was made with the intention of extracting the stone, extra peritoneally, through an incision in the ureter, or of pushing it onward into the bladder, but while trying to accurately locate and fix the stone in the ureter, it again slipped and could not be found.

The patient's condition now became critical, and both wounds were closed as quickly as possible. The patient rallied well, and was entirely free from pain until December 6th, when he had for the first time a severe and perfectly characteristic renal colic, associated with a sudden diminution in the quantity of urine, nausea, and vomiting. A similar attack followed the next day. The bladder was washed out with Bigelow's Evacuator on the day following the operation, and after the second attack of renal colic: but no stone was found. Shortly before the first attack of renal colic, there was marked tenderness on rectal examination.

On the tenth day a large fluctuating swelling was detected high up in the rectum; there was no communication between it and either of the wounds made by operation.

On the eleventh, the abscess was incised from the rectum, giving exit to about eight ounces of foul pus. No stone was found in this fluid, or the abscess cavity, but a small one might readily have escaped notice and been washed away in the first gush of pus. The abscess cavity extended far up in the course of the ureter toward the right kidney, but no communication between it and the ureter could be discovered.

The cavity of the abscess was packed with iodoform gauze; two drainage tubes were inserted, and their ends carried out through the anus. The rectum was packed above the incision with iodoform gauze for twenty-four hours. The packing and the drainage tubes were removed from the abscess cavity on the third and sixth days respectively. Very little pus came from the abscess, and the incision was healed completely on the tenth day.

The abdominal and lumbar wounds healed by first intention. From that time to the present (one year) there has been entire freedom from all pain. The patient has made a great gain in weight and is for the first time in several years enjoying perfect health.

During his convalescence from the operation, crystals of calcic oxalate were seen in the urine for the first time. The periodic diminution in the quantity of urine has, with the single exception of one period of three days, been absent.

The urine has been perfectly normal for six months, and the patient is in robust health.

This operation was begun as an exploratory one upon the provisional diagnosis of a calculus impacted in the ureter. This was suggested by the concurrence of sudden diminutions in the quantity of the urine, pain in the region of the kidney, and bladder irritability, and the absence of any other condition to explain the symptoms.

The supposition was proved to be correct by the detection of calculus with the finger, and only lacked final proof by removal of the stone.

It seems probable that the manipulation of the stone during the first part of the operation injured the ureter at that point; that ulceration, abscess formation, and the escape of the stone into the abscess cavity, followed in consequence, and that the stone was washed away and lost when the abscess was opened. That the operation brought about a radical change in the patient's condition, and cured the trouble, there can be no doubt.

Case II.

Abscess of the right kidney. — Cystic disease of the left kidney. — Exploratory laparotomy. — Double lumbar nephrotomy. — Permanent drainage of right kidney. — Recovery, with relief of symptoms.

June 18. Female, aged 24, unmarried, well until six months ago, when she was suddenly attacked with violent pain in the region of the vermiform appendix, and was operated upon for appendicitis, which condition was not found.

The patient was relieved of pain for one month, then had a number of characteristic attacks of renal colic in the right side. The urine contained no pus previous to the operation. A few blood corpuscles, and a trace of albumen, were the only abnormal constituents.

There was nothing to be felt upon examination of the abdomen and renal region.

On June 18 an exploratory incision two inches in length was made in the linea semi-lunaris midway between the ribs and the crest of the ilium, through this the kidney was palpated; fluctuating area was felt on its convex border. The abdominal wound was then closed, a lumbar incision parallel with the twelfth rib, and continued in a V shape downward along the border of the quadratus lumborum, was made; the flap thus formed was turned back and the kidney exposed. The peritoneum was slightly nicked, and was immediately sutured; no harm resulted: the fluctuating area in the kidney was incised, and about two ounces of pus were evacuated.

The abscess seemed to have originated in the cortex of the kidney, since it communicated by a narrow opening only with the pelvis, which was not dilated, nor did the organ present the characteristics of general pyo-nephrosis. Attempts to find the exit of the ureter, and to explore it, were not successful. No stone was discovered, although the ureter was palpated as far down as the iliac-vessels.

A drainage tube was inserted and retained for three weeks, the abscess cavity being daily washed with solutions of boracic acid, or permanganate of potash.

Twenty-six days after the operation the wound closed, the patient was up and about, feeling perfectly well again. Pus, however, which had been absent from the urine until the wound healed, now appeared, and at the end of ten days she had another attack of pain in the right kidney, and also for the first time in the left.

July 27. The *left* kidney was exposed by a lumbar incision similar to that made by the former operation. The *left* kidney appeared to be perfectly normal, except for a small cyst in its cortex containing about two drachms of clear fluid. This was evacuated by a small incision, the cyst wall was partly destroyed, and the wound in the kidney and the lumbar wound were closed tight. Hemorrhage was not severe. (The wounds healed by first intention, and there was no return of pain on that side up to the time of the patient's discharge from the hospital, six weeks later.)

The old wound of the *right* side was next reopened, and the abscess, which had refilled, was again emptied by incision and drained permanently, by means of a soft catheter passed through a curved hard rubber tube attached to a plate of the same material which was held to the side by elastic bands passed round the waist. This contrivance has the form of a tracheotomy tube and plate and suits its purpose excellently.

There was entire relief of pain in this kidney also after the operation. The patient left the hospital six weeks later in excellent condition. There was but little pus coming from the kidney through the wound and none in the urine.

This operation was undertaken upon the strength of one symptom alone; namely, pain, which occurred in the form characteristic of renal colic. The probability was that a renal calculus was present, although prior to the first operation there was no evidence in the urine of its existence or of the abscess that was found. That there was no absolute blocking of the ureter after the first operation on the right kidney, whether by calculus or other condition, is evident from the reappearance of pus in the urine as soon as the lumbar wound was closed. It is, on the other hand, difficult to explain the occurrence of the cortical abscess in the absence of calculus or tuberculous disease, or some obstructive condition in the urinary tract below the kidney. Calculus was not found. Of tuberculosis there was no evidence. (The urinary sediment and the pus issuing from the kidney through the lumbar wound having been frequently examined without detecting tubercle bacilli.) The ureter, as stated, was not, however, explored except by palpation through its upper two-thirds, and a stone may have been lodged in its lower third and possibly have been passed out through the bladder later. The return of pain on closure of the wound in the kidney and refilling of the abscess suggests, however, that the abscess was the source of pain. The operations were justified by the condition found in both kidneys, and the case illustrates the value of exploratory operation in cases in which the diagnosis cannot be carried beyond mere supposition.

Case III.

Disseminated abscesses of the right kidney (tubercular); subsequent involvement of the left kidney.— Lumbar nephrotomy (right side).— Six months later resection of the upper half of the right kidney.— Recovery, with marked gain in weight and general health.

June 25, 1895. The patient is an Italian woman, married, and about 25 years old.

For one year has had dull pain in the right lumbar region and over the right kidney, pyuria, and occasional hematuria and irritable bladder. Chills and feverish attacks, now

and then, and marked loss of flesh and strength. Six months ago Dr. Bolles performed a right lumbar nephrotomy, and opened and drained an abscess of that kidney. A fistulous tract giving exit to a considerable quantity of pus and urine remained from that time to the present. The patient was pregnant, and six weeks ago gave birth, without accident, to a child at term. Since then there has been a return of pain in the right kidney, an increased discharge of pus through the fistula, daily rise in temperature, weak and rapid pulse, pallor, and emaciation.

June 25. *Operation.* As a preliminary step, an incision two inches long was made in the left linea semi-lunaris, a little below the free border of the ribs, for the purpose of palpating the *left* kidney. This was readily done by two fingers passed through the wound. The kidney appeared to be of normal size and consistency. This wound was immediately closed, and the fistulous tract, from the former operation on the right side, was dilated sufficiently to admit the finger, which passed into a small abscess cavity in the cortex of the kidney. Other small areas of suppuration could be felt in the neighborhood of this one. The former nephrotomy incision was now reopened and extended into a V shape by a second incision parallel with the outer border of the quadratus. The flap thus formed was turned back. A portion of the kidney, which was adherent about the fistula, was separated by the finger. The whole organ was then freely exposed. Its lower half, so far as could be judged, was not diseased: its upper half was occupied by numerous small abscesses.

A nephrectomy had been intended: but in view of the apparently healthy condition of the lower half of the kidney, and of the improbality of the patient's surviving, in her then prostrated state, it was decided to do resection instead. This was carried out in the follwing manner:

Four large silk ligatures were passed close to the pelvis, through the cortex, at about equal intervals, from the top of the kidney downward to a little below its upper half, in such a way that when tied each should include a separate portion of the kidney, and constrict the vessels. These were then

drawn tight, the ends left long, and subsequently carried out through the wound. The sections of the kidney lying above these ligatures were then removed by the scissors and curette. There was no hemorrhage. The portion of the kidney removed was entirely occupied by numerous small abscesses, which proved to be of a tuberculous nature.

There was very little shock. Entire relief of pain within two days followed the operation, and a steady gain in flesh and strength followed in the next two months, during the last three weeks of which she was up and out-of-doors daily. Very little pus came from the wound, and there was almost none in the urine, which had been loaded with it before the operation, until the last fortnight of her stay in the hospital, when there was a sudden reappearance of pus in the urine, following a chill and an attack of pain in the other (left) kidney.

There had been a decided diminution of the hectic until the development of these symptoms pointing to the involement of the other kidney. The daily rise of temperature then became more marked again. Nevertheless the patient maintained the gain in strength and weight that she had made. So far as the author knows, this is the first case of resection of the kidney practised in Boston.

The tubercular nature of the disease had not been discovered at the time of operation, or the case would not have been considered an appropriate one for resection, but although there is no hope of ultimate recovery of the patient, the remarkable gain in her condition following the resection of the diseased half of the kidneys suggests that even in tuberculosis it may be a desirable thing to do, if on exploration such a condition of the kidney, as was found in this case, should be met with, rather than a nephrectomy with the patient in such a critical condition. The author would call attention to the manner in which the ligatures were applied to the part to be removed, and to the fact that no hemorrhage occurred during the operation. The ligatures were placed in this manner, with the intention of constricting the blood-vessels in their main branches before their subdivisions in the cortex.

Case IV.

Renal calculus. — Acute Pyo-Nephrosis occurring in a movable kidney. — Exploratory laparotomy, followed by lumbar Nephro-lithotomy and Nephrorraphy. — Recovery, with closure of wound.

Sept. 5, 1895. Female, 29 years. The patient was well until two weeks ago, when she had an attack of moderate pain in the region of the right kidney. Two days later she noticed a tumor in the right side of the abdomen below the free border of the ribs which has steadily increased in size. There has been rapid loss of flesh and strength, constipation, and apathy; no urinary symptoms, so far as she knows.

In the right side of the abdomen, most prominent in the region of the cæcum, is a freely movable, semi-elastic, smooth tumor of the size of two fists. It can be moved upward and backward, or downward easily, but not beyond the median line. There is no pain or tenderness about the tumor.

The diagnosis lay between an acute hydro or pyo nephrosis in a movable kidney, and a small ovarian cyst with suppuration or twisted pedicle, with the probability in favor of the kidney. The patient's condition was very poor, and she was rapidly growing worse.

Sept. 5, 1895. *Operation.* An exploratory abdominal incision was made over the most prominent part of the tumor, which was presently seen to be the right kidney, greatly distented by fluid and displaced downward from its normal position. The peritoneum covering its anterior surface was not disturbed. After protecting the anterior wound with a sterilized gauze pad, the patient was turned upon the left side and the V-shaped cut described in connection with the preceding cases was made. The kidney was then pressed firmly outward in the lumbar wound by an assistant's hand passed through the abdominal wound in front. The kidney was then opened by an incision three inches long through its convex border. About ten ounces of foul-smelling purulent urine at once escaped. Upon ex-

ploring the pelvis a rough elongated oxalate of lime calculus one-half an inch long, and with the circumference of a small slate-pencil, was found. The calculus was firmly imbedded in the ureteral orifice, which it wholly occluded. Just after dislodging it with forceps, it broke in their blades longitudinally, the smaller of the two fragments dropped in the dilated pelvis, but was passed subsequently through the wound.

The cortex of the kidney was dilated into several large pus cavities. The walls dividing them were broken down with the finger so as to make one large cavity. This was thoroughly cleansed. The edges of the kidney wound were sutured to those of the lumbar wound by four silk sutures, two rubber drainage tubes were carried into the pelvis of the kidney, and the wounds were left to heal by granulation.

It should have been stated that the tip of the vermiform appendix was bound to the lower end of the kidney by firm old adhesions, and the separation of these and the removal of the appendix were the first steps in the operation. The patient made a rapid and uninterrupted recovery. Twenty-four days after the operation the wounds were healed, and she went home well.

There was no pus whatever in the urine at the time patient left the hospital. This case has special interest from the facts:

(1.) That it is one of the very few (two or three on the authority of Albarran) in which pyo-nephrosis has been noted in connection with floating kidney. The coincidence is no doubt accidental, and the pyo-nephrosis is referable to the presence of a calculus, and would have been quite as likely to occur in a kidney not movable, and the kidney may have become movable owing to the weight of the organ due to the pyo-nephrosis.

(2.) That there was entire absence of symptoms referable to the kidney until within a fortnight of the operation, which demonstrated so serious a condition of the kidneys, including the presence of a rough calculus blocking the orifice of the ureter.

(3.) That the adhesion of the appendix to the lower end of the kidney from a long-standing process suggests that in

this particular case the displacement of the kidney may have occurred because of this connection with the appendix.

Case V.

Movable kidney. — Exploratory laparotomy. — Lumbar Nephrorraphy. — Recovery, with entire relief of symptoms.

Sept. 7, 1895. Patient a woman, married and a multipara, is thirty-three years old. She is stout and has somewhat relaxed abdominal walls. In robust health until one year ago, then began to have attacks of pain in the left kidney. The pain, which was intermittent and radiating in character, began beneath the twelfth rib and extended downward to the groin. The bladder was frequently irritable during these attacks of pain. The attacks, which were not very severe at first, gradually increased in intensity and became more frequent, and for the last three months have incapacitated the patient for work.

The examination of the patient was negative with the exception of a sense of increased resistance on the left side of the abdomen below the free border of the ribs, and a marked tenderness, upon pressure, below the twelfth rib. Urine was normal.

Operation. — An exploratory incision was made on the left side of the abdomen sufficient to admit two fingers and to explore the kidney; the latter was found to be somewhat enlarged and freely movable. It was also (when the patient lay upon the right side) in a position of anteversion. The patient having been turned upon this side, the incision, as for lumbar nephrotomy, was made parallel with the last rib, and the kidney exposed in the loin. It was then sutured to the deeper edges of this wound by six stout silk-worm gut sutures which were passed through the fibrous capsule of the kidney, at intervals of about half an inch, beginning near its upper end and continuing along its convex border to the middle of the organ. The sutures were not drawn very tight. The capsule was not incised. The outer wound was then sewed tight, and the abdominal wound was closed, it having been left open until the end of

the operation in order to facilitate the suture of the kidney in the loin.

The patient had a good deal of pain during the two days following operation, but it was easily controlled with morphine.

The recovery was only interrupted by a superficial abscess, which developed on the sixth day, owing to urine having soaked into the dressing while urinating, the dressing having been carelessly carried too low down and between the legs.

The wound was entirely healed on the twenty-fourth day after operation and the patient discharged well.

The patient stated that she was absolutely free from the pain which she had had for the past year.

It will have been noticed that in all of these cases the operations were begun by an exploratory laparotomy. This was done because the diagnosis was so doubtful that it seemed to the author the best method of proceeding, but he would not be understood as advocating it except under such special conditions.

V.

RESECTION OF THE HEAD OF THE HUMERUS FOR OLD IRREDUCIBLE DISLOCATION.

By G. H. Monks, M.D.

A man, 59 years of age, was admitted to the hospital October 1, with an old dislocation of the humerus. While wrestling some ten months before, he stumbled and fell side-

wise, striking upon the left arm and shoulder. A physician was called, who made the diagnosis of dislocation. The dislocation was reduced, but that night the head of the bone dropped out of the socket again. The next day it was again

put back, but dropped out again soon after, and remained dislocated until the present time, the man having sought no medical assistance whatever. On admission to the hospital the dislocated shoulder was carefully examined and found to be of the subcoracoid variety, with atrophy of all the muscles about the shoulder-joint, as well as of the muscles of the arm and hand. The patient's grasp was very weak, and voluntary movements extremely limited.

A careful examination of the condition of the nerves was made by Dr. Prince, one of the neurologists of the hospital. His report states that there was complete ulnar paralysis as well as partial paralysis of the median, musculo-spiral, and circumflex nerves. The man declared that he had been daily losing power in his arm up to the time he entered the hospital, when he stated that it was about useless. The question arose as to whether operative interference should be attempted, and Dr. Cheever and Dr. Prince kindly acted as consultants in the matter. It was finally decided that, under the circumstances, excision of the head of the bone would relieve the pressure upon the nerves, and that possibly, to a certain extent, their functions might be restored. With the patient's consent, therefore, I excised the head of the humerus on October 17, through an incision in the anterior margin of the deltoid. The muscles in this operation were the supra-spinatus, teres minor, and sub-scapularis. The long tendon of the biceps was dislocated from its groove, but not divided. The wound healed rapidly by first intention, and the patient was very soon able to use his arm to a far greater degree and with a much greater range of motion than was possible before the operation. He was very much pleased with the result of the operation. The condition of the nerves, also, improved considerably, but I am told by the neurologist that six months or a year will have to elapse after the operation before any very marked improvement can be noticed. Even if no further improvement actually does take place in the condition of the nerves, I should feel satisfied with the result of the operation, in that the patient has thereby secured a much greater range of motion and a corresponding increase in the usefulness of his arm. It may be interesting to note that the head of the bone was very much

atrophied, and that, on being removed, it could be easily crushed in the bone forceps, showing pretty conclusively that had an attempt been made to reduce the dislocation by manipulation, a fracture would probably have taken place at the neck of the bone, and thus a new complication would have been added, and no good whatever accomplished.

In view of the good result thus far obtained in this case, I think I should be in favor of excising the head of the bone in any case of old-standing irreducible dislocation of the humerus, where the function of the arm has been so seriously interfered with as in this case.

VI.

SOME METHODS OF ROUTINE TREATMENT IN THE SURGICAL OUT-PATIENT DEPARTMENT.

By the Surgeons to Out-patients.

Those treated at the Out-patient Department of the City Hospital fall naturally into two main classes, of which the first consists of patients who have been in the hospital for some time, and, after discharge, return for convalescent treatment; and the second, those who never have been in the hospital, but have been out-patients from the beginning. Patients of the first class present themselves to the out-patient surgeon wearing dressings or apparatus customarily used in the hospital. So far as possible, such dressings and apparatus are continued. The second class, which may be considered to represent the type of out-patient pure and simple, will serve best to illustrate the methods of routine treatment.

The out-patient clinic varies from one hundred and fifty to two hundred patients a day, occasionally running above or below these figures. Patients are admitted between the hours of 9 and 11 A.M., and are examined and dressed with as much despatch as possible.

Two self-evident facts are always borne in mind in regard to dressings: the first being that, as a very general rule, the dressings applied are not to be removed until the patient returns; and the second, that since most patients walk to and from their homes, which are usually in the poorer parts of the city, dressings and apparatus are much more subject to disturbing influences, and much more likely to be loosened or displaced, than is the case with private or house patients. It is obvious, therefore, that the one quality of a dressing which must be unusually accentuated is, that it

should be applied in such a manner as to remain precisely where it is placed. This has resulted in the adoption of a cheese-cloth bandage in a certain percentage of cases, and in the abandoning of the cotton roller in a similar proportion. The cheese-cloth bandage (or gauze bandage, as it is usually called) not only stays in position more securely, but is more easily and quickly applied, and, owing to its increased elasticity, may be applied with force without detriment to the circulation. In dressings of the head and lower leg, and in children, it is particularly of value. It is prepared, as a rule, by winding it in yard widths over a large bandage-roller of the ordinary type; and after being rolled it is cut into sections of convenient size, usually from four to eight inches. The objections to it are that it is more difficult to roll, it is rather hard to free the edge of the individual bandages from entangling ravellings; and it is apt to loosen at the edges, and for this reason is rarely or never used in the application of splints.

The number and variety of dressings which the Outpatient Department affords is very large, but those which are usually applied in a majority of cases probably do not exceed a dozen. An aseptic dressing is reserved for strictly appropriate cases, which are proportionately few. The antiseptic dressing is most common: boracic gauze forms the basis, saturated in whatever solution the surgeon prefers. The very strong corrosive-sublimate solutions have given way largely to more dilute strengths, and creoline or sulphonaphthol have come into use. To diminish evaporation in moist dressings oiled paper is substituted for oiled silk, from economic reasons only: non-absorbent sheet-wadding is usually added outside the oiled paper, particularly when warmth is desirable. A minor objection to these gauze dressings, and apparently the only objection, is the fact that when dry they adhere closely to wounds and granulating surfaces. As a rule this can be almost entirely overcome by soaking in hot water or creoline before attempting to remove the final layer of the dressing.

Dressings moistened with permanganate of potash in saturated solution have given excellent results during the past

year or two. The strength of the permanganate of potash solution is about one to twenty, and it is used just as any other wet dressing. It may be applied even to clean wounds, but is more strongly indicated in sloughing or purulent conditions, and in ulcers of the leg, being particularly effective in the latter class of cases. Contrary to what might be expected, it does not tend to cause irritative dermatitis more than other antiseptics.

Ointments, when used as a later treatment of wounds or burns, are spread upon the smooth side of canton flannel. Vaseline rubbed up with boracic acid in the proportion of one to eight is perhaps most commonly employed. Iodoform is much more rarely used than formerly, but is often applied as an ointment of ten per cent. strength. As a powder iodoform is most frequently of value in sloughing wounds, in packing sinuses, and in suppurating scalp-wounds, especially where the bone is exposed. In these latter cases a slender bougie containing three to ten grains of iodoform, inserted into the wound, often gives most satisfactory results. In wounds of this description none of the odorless substitutes seem to do as well as iodoform.

There is but one style of sling in use, and this is made of bleached cotton cloth. A piece of cloth one yard square is cut in two from diagonal corners, each of the triangular pieces making an adult sling. When applied it always extends from below the ends of the fingers, along the forearm, and one-third of the way up the humerus. It is gathered snugly above the elbow and held in place by pins. The long ends are knotted behind the neck, the knot placed at one side of the middle line in order that it may not press too heavily upon the flesh. A double sling is sometimes used to obtain more complete fixation. It consists simply in the addition of a second sling over the first; this goes around the chest like a swathe and binds the arm firmly against the breast, the ends being knotted under the free arm. Its only advantage over a swathe is that it seems to stay in position better and is more easily applied.

A large proportion of cases of fractured ribs are treated from the beginning in the Out-patient Department. As a

rule, such cases are referred to the House only when some pulmonary complication or a considerable amount of shock accompanies them. In many cases crepitus cannot be made out, and a severe contusion of the chest is not always evident: but the treatment is the same, and consists in the application of an adhesive-plaster swathe completely around the chest. A resin plaster made fresh each morning in the

hospital is ordinarily used: the strip is about eight inches wide and long enough to encircle the chest. It is applied by what is known as the "peg-top" method. The patient, stripped to the waist, is instructed to exhale thoroughly, and then to spin around on his toes, while the assistant holds the plaster against the chest at the appropriate elevation and angle. In this way the patient literally winds himself up in the plaster. After a little practice an assistant learns to apply a plaster swathe in this manner with remarkable snugness and with freedom from wrinkles. The

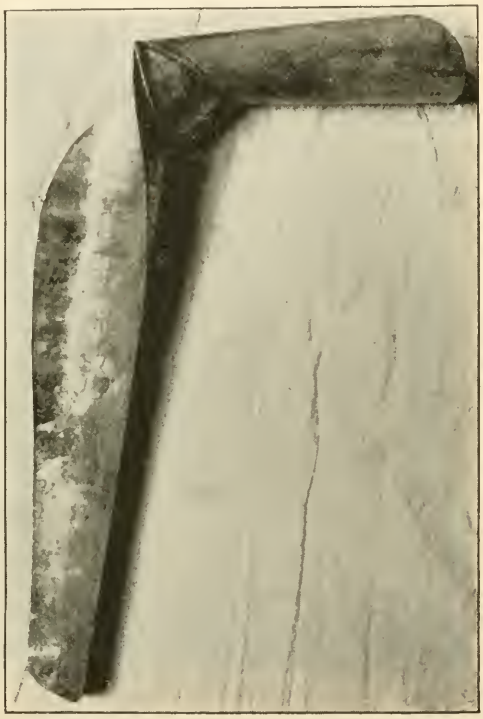
relief from pain is usually considerable and immediate, and this dressing has the unique distinction of being the only one which never becomes loosened and is never removed before returning. It is seldom advisable to shave the chest before applying such plaster swathes, because the hair grows again so rapidly that by the time the swathe is taken off little has been gained by shaving. The application of ether,

alcohol, and hot water facilitates the removal of the plaster from such hairy chests. If in the latter stages of these cases a cotton swathe is used, it is always advisable to hold it in place by suspenders over the shoulders.

An adhesive swathe is also used in fractures of the clavicle in children, and in these cases is a modification of the Sayre method. Instead of winding around the upper arm and then passing across the back, the strip of plaster is applied as follows: the arm is placed in position backwards and against the side, and the plaster encircles arm

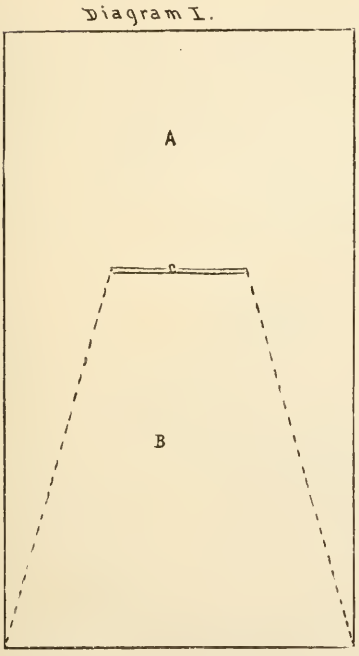
and chest together. This is used because it has been found that the plaster applied snugly about the upper arm interferes with the circulation below. The rest of the dressing follows the usual Sayre method.

Tin is much used in the Surgical Out-patient Department, both for fixation, as in fractures, dislocations, or extensive wounds, and for the treatment of ulcers. Tin splints are

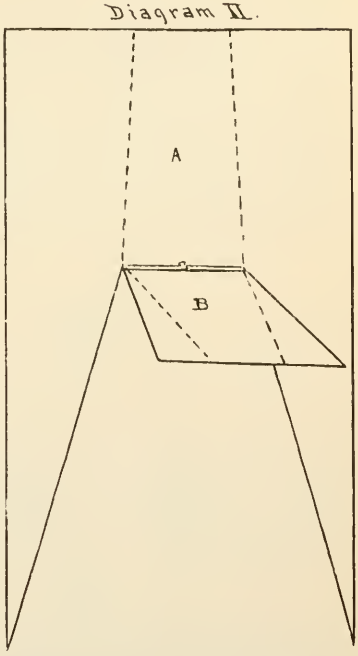


applied in fractures of toes, fingers, in the maxilla, humerus, and in certain fractures of the elbow, but in these latter cases much less frequently than before the acute-angle fixation was introduced. When a splint is used in these cases, or in fracture of the humerus, the Smith internal angular splint is almost invariably employed. This is a modification of the old right-angle internal angular splint, and the essential distinction lies in the fact that the lower arm of the splint has been rotated on its long axis inward, so that the fore-

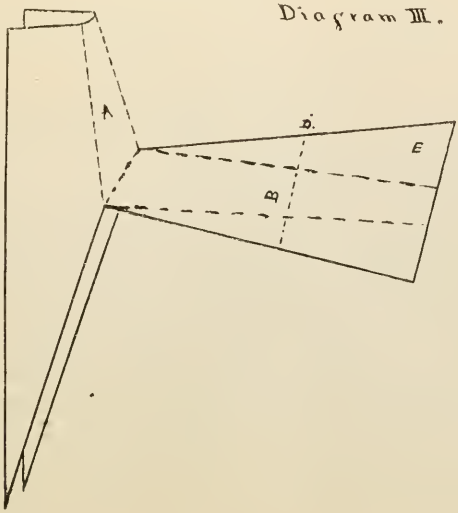
arm and hand rest against it in the natural position halfway between pronation and supination, and not in the old-



Cut tin as indicated by dotted lines; bend segment B until it makes a right angle with A at double line C.



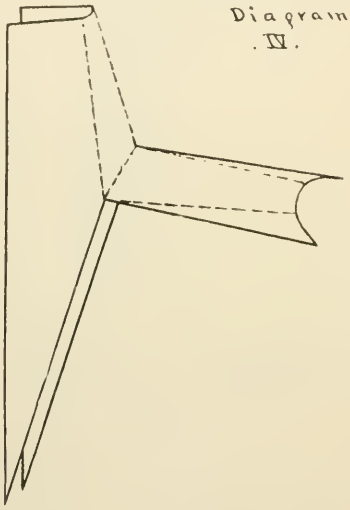
Showing A and B at right angles; the red lines indicate where moulding is to take place.



Showing thumb portion A moulded into shape; excess of tin E, is cut off at D, then B is moulded along the lines.

fashioned and very uncomfortable position of complete supination. This is not only much more comfortable, but also brings the bones of the forearm into a normal position.

With this exception, tin splints are made to order for each case. A certain amount of time and not a little ingenuity and mechanical skill are necessary to produce a properly fitting tin splint, but once made it is indestructible and is very comfortable for the patient. The edges are bound with adhesive plaster and sufficiently padded. A form of splint first constructed by one of the House officers of the hospital

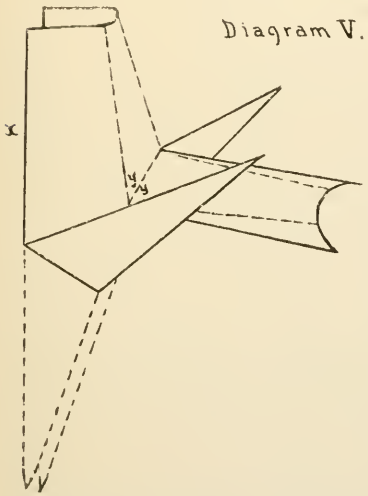


Index finger portion moulded into shape.

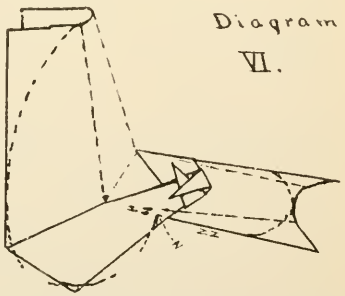
is shown in the cuts. These splints are admirable for simplicity and mechanical adaptability.

The treatment of chronic ulcers of the leg is always an important matter in out-patient clinics. The methods of treatment are almost as numerous and varied as are the patients. The controlling factor in these cases is usually the fact that the much-needed physiological rest cannot be bestowed on the affected limb. Only two features of the treatment of ulcers at the Boston City Hospital will be mentioned. The first is the invariable application of a firm and, if possible, slightly elastic bandage, from the toes to or above the knee, in every case: when practicable this

bandage may be removed at bedtime and reapplied on rising: and the second is the treatment by the so-called "antiseptic tin." It consists essentially in placing over the ulcer a bit of tin cut so as to conform accurately to the edges, as well as to the curves of the leg, thus protecting and at the same time giving uniform pressure upon the granulations from a smooth surface. The tin extends an eighth of an inch beyond the rim of the ulcer, and is moulded to fit with perfect exactness. It is smoothly covered with oiled paper,



Showing method of locking. The tin is so bent that the border x meets the angle yy, and is tapped into place e with a hammer.



Showing lock completed. The black dotted line shows the shape when trimmed. The small triangular portion z is turned under the border zz, and fixation is complete.

and the whole is soaked in a strong antiseptic solution. The ulcer itself is filled to the general level of the healthy skin with calomel or iodoform, the tin placed carefully upon it, and held in place by adhesive plaster straps. The leg is then bandaged as above described. In a majority of cases the size of the ulcer diminishes with a rapidity which is most gratifying to both patient and surgeon. The dressing should be changed daily, particularly in cases in which there is a considerable discharge from the granulations.

The methods of treatment thus briefly described do not, of course, include more than a very small percentage of the dressings applied daily in the Out-patient Department. They have been chosen rather as examples of treatment which

differ to a greater or less degree from the ordinary, and which have been found to be peculiarly well adapted to the needs of the Surgical Out-patient Department of the Boston City Hospital.

A STUDY OF SOME FRACTURES OF THE UPPER EXTREMITIES.

In the Surgical Out-patient Department of the Boston City Hospital there were found notes of some 750 fractures applying for treatment in the twenty-three months from Jan. 1, 1894, to Dec. 1, 1895. This applies simply to cases presenting themselves one or more times at the Surgical Out-patient Department. Some of these had been originally treated in the hospital wards, and had been discharged from there; some came after being originally treated at other institutions, or by outside physicians; while still a third class came originally to the Surgical Out-patient Department, and were suitable for treatment here.

It is obviously impossible to present any valuable generalizations or conclusions about this group of fractures taken as a whole. Seen early or late, treated by all sorts of methods, attending irregularly and stopping attendance most often at their own discretion, the patients making up this group are, taken as a whole, useless for clinical study.

An attempt has been made to study some of the fractures of the upper extremities, to see if any practical deductions might be made from the consideration of so large a group of cases. The patients, it must be remembered, represent on the whole a low class in the community, dirty, ignorant, and often drunken, so that these patients constitute perhaps as poor material as one might find. It is interesting to note that in their distribution the fractures are very similar to the group of 51,938 cases studied at the London Hospital, including, as here, hospital and out-patients together.

Those fractures were distributed as follows:

The head constituted 3.8 per cent.

The trunk, 17.4 per cent.

The upper extremity, 52.2 per cent.

The lower extremity, 26.7 per cent.

Colles' Fracture. — Of 154 cases applying in the twenty-three months between Jan. 1, 1894, and Dec. 1, 1895, there

were eighty-four women and but about seventy men. This, of course, is a reversal of the general relation in fractures, inasmuch as all statistics show that fractures are more numerous in men than in women in the proportion of three to one, and in middle life fractures are ten times as frequent in men as in women.

In the treatment of this group of cases, it may be said that all recent cases coming to the hospital were reduced as completely as possible, in the majority of cases under ether, and that all wore splints. A palmar splint was worn in all cases, either being a straight piece of wood padded and covered, or a carved wood splint of the pattern known as the Bolles splint, or a plain board with a roll at the end, of the pattern known as the Bond splint. In most of the cases a dorsal as well as a palmar splint was worn. The latter consisted of a short plain piece of splint wood padded and reaching either to the wrist or further down to the fingers. Some of the out-patient surgeons used only the palmar splint from first to last. The palmar splint was in no case removed earlier than the twelfth day, and was not left on longer than thirty-six days, the average time in sixty-five cases being twenty-four days. The dorsal splint where used was removed in one case in three days, and in the longest case was continued for twenty-eight days, the average time of removal being twelve days.

As it was desired to investigate the ultimate results of as many cases as possible, those cases were selected for this investigation which applied between January 1, 1894, and July 1, 1895, so that no very recent cases were investigated. One hundred and sixteen cases were thus investigated. Letters were sent, and a careful search for these patients at their homes resulted in the collection of thirty-nine cases applying at the hospital during a period from two years to six months before the inquiry was begun. This proportion was perhaps as large as could be expected in such a class of patients.

Of these thirty-nine patients twenty were classed as "useful hands without symptoms." These patients on their own testimony had no discomfort of any kind as a result of the fracture. In these cases the motions were normal, even to

supination and pronation, and the flexion of the fingers was noted as good. Yet in nearly every case of this group, as of the others, an increase in the breadth of the wrist was noticed, which was from $\frac{1}{8}$ to $\frac{1}{4}$ inch wider than the wrist of the opposite side. This measurement was obtained by measuring with a calliper the distance between the head of the ulna and the styloid process of the radius.

Five cases were classed as "useful hands with symptoms." All had normal motion and the same characteristics as in the previous cases, but frequently pain or numbness.

Fourteen cases were classed as fair results. Pain was present in all of these. It was sometimes only occasioned by lifting, and was generally at the radial side of the wrist. It was not constantly present in most cases. Numbness was present in seven cases, and in one a general impairment of function was noted. Light work could be done, but not heavy work as before. Several of these cases had a limitation of flexion in the fingers not amounting to disability, and one complained of persistent swelling.

In a general way, these were the characteristics of these patients as seen months after the injury.

It was desired to study more in detail the characteristics of the deformity at the wrist, and two points were taken up: (1) the broadening between the head of the ulna and the styloid process of the radius, and (2) the relation of the level of the styloid process of the radius to that of the ulna.

As has been said, in all cases treated in the wards or in the Out-patient Department, the fracture was broken up as thoroughly as possible, with or without ether, and the arm put in the correct position. It proved generally impossible to reduce entirely the injury to the radius, as may be seen from the two points studied.

(1.) *Broadening between the Head of the Ulna and the Styloid Process of the Radius.* As studied in these thirty-nine cases, although in all but three cases widening existed, it did not in itself prove that a limitation of usefulness was present.

In three cases the injured side was not wider.

In twenty-four cases the injured side was $\frac{1}{8}$ inch wider.

In nine cases the injured side was $\frac{1}{4}$ inch wider.

In one case the injured side was $\frac{3}{8}$ inch wider.

Cases where the widening was $\frac{1}{4}$ inch or more were analyzed to see if this amount of widening affected the functional result. Of ten cases of this sort only one belonged to the class of "useful without symptoms." If one might generalize from so small a group of cases, it would seem that a widening of $\frac{1}{8}$ inch between the borders of the wrist was not a significant amount, but that widening of $\frac{1}{4}$ inch was, as a rule, accompanied by some impairment of function.

(2.) *The Level of the Styloid Processes.* The fact that the styloid process of the radius was higher in its relation to the ulna than normal in the group of cases studied did not seem to be the accompaniment of a disabling condition. In thirty-four cases the styloid process of the radius was noted as being higher than on the other side, and in five it was on the same level. Of these five cases three belonged to the class of useful with no symptoms, while the other two were only fair results; the conclusion being that elevation of the radial styloid process was not, like a marked increase of width between the styloids, the accompaniment of a condition of impaired usefulness.

To determine whether age affects the relations between the styloid processes, seventy normal wrists were measured, with the following results. The measurements were made by one person, the wrists always being held in the same position; that is, with the elbow flexed and at the side, the hand in pronation and flexed naturally at the wrist, the ordinary position for measuring the level of the styloid processes in Colles' fractures. Most of the measurements were made either in children or in adults over fifty years of age. The difference between the level of the lower end of the styloid processes is indicated in thirty-seconds of an inch. In a very few instances a difference of $\frac{1}{32}$ of an inch was found between the measurements of the two sides in the same individual. In thirty children under fifteen years of age only one was found with so low a difference in level as $\frac{7}{32}$ of an inch, the highest being $\frac{12}{32}$. In twenty-six cases over forty years of age no difference of level greater than $\frac{6}{32}$ was found, and none less than $\frac{1}{32}$. The general average in persons between

One and twenty years was $\frac{9.4}{32}$ of an inch;
Twenty and forty years was $\frac{7.8}{32}$ of an inch;
Forty and sixty years was $\frac{4.1}{32}$ of an inch.

A classification by sexes showed almost no difference from the average given above, although to determine this accurately a much larger group should be investigated.

If the actual difference in the level of the lower radial and ulnar ends amounts to over $\frac{9}{32}$ of an inch in a child and to less than half that amount in old persons, the relative difference is most striking. Assuming the length of the bones of the forearm in a child six years old to be $7\frac{1}{2}$ inches or $\frac{240}{32}$ and the length of an adult's forearm to be 11 inches or $\frac{352}{32}$, then the relative difference in the radio-ulnar level in the child would be $\frac{1}{26}$ of the length of the forearm, while in old people approximately $\frac{1}{86}$ of the length of the forearm. That is, in the child it is about $3\frac{1}{3}$ times as great, relatively, as in the adult.

Antero-posterior thickening of the radius was present in every one of sixty-two cases analyzed in this regard. In twenty cases it was classed as slight; in fifteen cases it was classed as moderate; in sixteen cases it was classed as considerable; in eleven cases it was not classed, but was present.

The recovery of normal motion in so large a proportion of these thirty-nine cases seems worthy of note. In only four cases was rotation limited, and an analysis of these four showed that they were exceptional cases. One had been reduced twice, the second time for deformity; one was treated first three weeks after injury; one was a second fracture below an old one; one was not treated anywhere until ten days after injury. All other cases recovered normal rotation.

It is of course well known that the age of the patient is an important factor in determining complete recovery from Colles' fracture. Of the twenty cases where the hand was classed as "useful without symptoms," the average age was twenty years; while in the nineteen cases where some symptoms were present, such as pain and stiffness, the average age was forty years, being twice as much.

Atrophy of the posterior half of the deltoid muscle as a result of Colles' fracture is a complication which has received

but little attention, but it occurs not infrequently from some unknown cause. It was looked for in each of the thirty-nine cases where the ultimate results were investigated. Nine cases showed this type of atrophy, while in thirty it was not present. The nine cases where it was present were average cases, and did not indicate that this was the accompaniment of a disabling condition.

As a summary of what has been found in these cases, it might be said that in a general way recovery with perfect restoration of function was not uncommon, even in hospital patients; that complete restoration of the shape of the radius was very unusual, and that shortening of the radius, as shown by the level of the styloid processes, was not so serious a matter as an increase in distance between the styloid process of the radius and that of the ulna, especially if this increase was $\frac{1}{4}$ inch.

Fractures of both bones of the Forearm. — A group of cases was considered in the same way as those of Colles' fracture, where fracture of both bones of the forearm had occurred in the same period of time as considered above. One hundred and sixteen cases were treated, and thirty-nine cases were taken for analysis. These were originally treated at the Out-patient Department, and not elsewhere. It was possible to find twelve of these. Of the thirty-nine cases taken for consideration, the fracture was complete in twenty-seven and greenstick in twelve. There were thirty-five males and four females, which is, of course, nearer the normal relation than in the cases of Colles' fracture. The cases were treated with palmar and dorsal forearm splints, and where the fracture was high up in the forearm an elbow splint was added. The splints were removed on an average in four and one-third weeks. The longest case recorded was one where refracture was necessary and the splints were kept on for seven weeks. The results from the record books were classed as follows:

Good, 29.
Fair, 1.
Bad, 2.
Indefinite, 7.

Considered, however, in the light of the results the record

is excellent. Ten patients had useful arms with no symptoms, and but two complained of slight weakness on lifting weights. These cases were respectively one year and a year and a half after fracture. Rotation was perfect in every case, and there was no case of marked deformity, although a slight outward bowing was noticed in three cases, and a slight inward bowing in two cases, but it was very slight. The callous was to be felt in about half of the cases, while in the others nothing abnormal was to be found. The cases taken for consideration all happened to be either children or young adults, so that probably there has been considered here the most favorable class of cases to be presented.

Fracture of the Scapula. — Of ten cases of fracture of the scapula, which were recorded in the twenty-three months taken up for consideration, the following four are presented as possibly being of interest, inasmuch as fracture of the scapula is somewhat uncommon.

1. Male. History of violence to shoulder on previous day. Below the spine of the scapula and close to it on the vertebral border were swelling, mobility, and crepitus. Patient was treated with wood-fibre saddle. On the sixteenth day the splint was removed, and there was no pain or swelling. A month later a slight atrophy of the soft parts, with indentation of the bone just below the end of the spine of the scapula was noted.

2. Male patient was run over by a wagon two weeks before examination, the wheel passing over the upper portion of the left scapula. There was ecchymosis over the border of the axilla and on the humerus. The patient had had no treatment. Crepitus was doubtful, but just below the origin of the triceps there were found increased mobility and abnormal tenderness, giving undoubted evidence of fracture. The patient was treated by fixation of the arm, accompanied by a double sling. Fifteen days later there was good union, no deformity, and normal shoulder movement.

3. Male patient. Fell on shoulder the same day that he was admitted. There was well-marked crepitus and local tenderness over coracoid process. Dressed with a sling and a swathe, and seventeen days later the coracoid was firmly united, but slightly more prominent than normal. Three

weeks later there was still slight tenderness over the coracoid, with moderate bony enlargement. Movement of the shoulder joint was through about half of the normal arc, and though there was no pain there was some stiffness of the joint.

4. Male. The patient came in within twenty-four hours after the accident: slipped on the sidewalk, and in falling struck his right scapula. There were crepitus and mobility at the lower end of the bone, the line of fracture crossing about one and one-half inches above the lower angle. With the scapula in the position of rest the lower fragment was depressed, lying closer to the trunk than the upper, but by carrying the corresponding hand across the chest to the opposite shoulder the fragments rode into place, and were held in that position by a swathe and a bandage. Good union in the correct position followed.

VII.

THE RELATION OF THE THYROID GLAND TO CERTAIN DISEASES OF THE EAR, WITH A THEORY OF ITS FUNCTION.

By Edmund D. Spear, M.D.

The study of the function of the thyroid gland has become of increasing interest to the medical world, especially since some curious results have been obtained by the removal of this gland, and in the treatment of that rare disease called myxœdema. A considerable mass of literature is being daily added to by the many observers now engaged upon the study of this gland's function, but, as far as I know, very little definite knowledge has been given us. Usually the experiments are recorded and their results noted, but few inferences except such as are of a general character are made. It is evident that the thyroid gland is necessary to the life of the possessor, but whether or not certain tissue metamorphoses are pathologically dependent upon a disturbed function of the gland is still undecided.

As this paper deals with certain phenomena which are entirely clinical, and not with the surgical questions involved, these problems are only referred to. In connection with these remarks, and illustrative of the uncertainty pertaining to this matter, I quote the following extract from the paper of an English writer:[1]

"The nature of the colloid material of the thyroid gland has been the source of much divergence of opinion in the past, and notwithstanding the researches of many inquirers, our knowledge of it is still uncertain. Of its mode of origin — whether by a secretive or by a degenerative pro-

[1] "On Colloid in the Lymphatics and Blood-vessels of the Thyroid in Goitre." By R. M. Horne, M.B., C.M., Edinb. "Journal of Anatomy and Physiology," London, 1892, 3, Vol. 27, pp. 161-168.

cess — we are still in doubt: of its chemical composition, and of the part it performs in the physiology of the gland, nothing definite is known: of its ultimate fate we also know but little.

"In recent years the lymphatic system has come to be regarded as the duct of the thyroid, as the channel by which the colloid material is removed. The only ground for this view lies in the presence of colloid in some of the lymphatics of the gland.

"Baber,[1] working with dogs' thyroids: Biondi,[2] with thyroids of amphibians, birds, and reptiles: Langendorff,[3] with thyroids obtained from recently killed calves and young dogs: and Horseley,[4] with thyroids of young monkeys, — all have demonstrated the presence of colloid in the lymph system of the vessels. Horseley has shown further that colloid is also present in those lymph glands towards which the lymphatics of the thyroid pass. It is believed by these observers that the colloid present in the lymphatics has come from the follicles of the gland. All attempts, however, to find a connection between the follicles and the lymph vascular system have failed, so that if this system really acts as the 'thyroid duct' we are still in doubt how the thyroid secretion finds its way thither.

"Till May of the present year no observations had been made on the behavior of the lymphatics in the human thyroid. At that time Podbelsky[5] published a short account of his research on this subject."

In the fall of the year 1889 my attention was attracted to the thyroid gland and its function in relation to diseases of the ear and upper air-passages. A line of investigation was suggested to me by the consideration of two statements made by Nothnagel,[6] in Ziemssen's "Cyclopedia of Medicine." The first statement was as follows:

"The thyroid gland is to be regarded as furnishing

[1] "Proceedings of the Royal Society," Vol. 24.

[2] "Berliner Klinische Wochenschrift," 1888, No. 47.

[3] "Archiv. fur Anatomie und Physiologie," Suppl. B., 1889, pp. 219–240.

[4] "British Medical Journal," 1892, No. 1622, January 30, pp. 2–7.

[5] "Prager, Medicinische Wochenschrift," 1892, Mai 11 and 18, Nos. 19, 20.

[6] "Nothnagel, Anæmia, Hyperæmia, etc., of the Brain," Ziemssen's "Cyclopedia of Medicine," Vol. 12, p. 6.

a further means for the regulation of the intra-cranial circulation.

"Maingien ('Archives Generales de Med.,' 1870) was led by a series of investigations (partly from the point of comparative anatomy) to the conclusion that this action of the thyroid gland lies in the fact that, when under excessive muscular exertion, the veins of the neck are compressed, and there is danger of venous congestion in the brain, this gland also becomes swollen, and in its turn compresses the carotids, being itself held firmly against the vertebral column by the contractions of the muscles of the neck."

Illustrative of this control of the cerebral circulation by the thyroid is the following: During the act of crying one may be conscious of a sensation in the sides of the neck, especially pronounced and uncomfortable when one's tears must be "choked back," as we say. This sensation is from the pressure of the swelling thyroid struggling in an effort to repress the evolution of the emotion which if carried through spontaneously would have ended in a "flood of tears," and with the sense of relief which all of us have felt when the natural process has not been interrupted or interfered with.

At the same time the crying fit is at its height we are also conscious of a stuffed feeling in the nose and of a disturbance going on in the region of the heart, where there may be sensations of real pain as if, at this crisis, this organ were being torn or rended. When the hysterical patient allows herself to begin with a paroxysm, one often sees her placing her hands upon her throat as if to tear out in her agony the offending something which chokes and annoys her. This, however, she cannot remove, for it is a similar sensation due to the swelling thyroid gland. The peculiarity of this is such that it has received the significant name of "globus hystericus."

The other statement by Nothnagel was to the effect that an enlargement of the gland occasionally occurred in women at the catamenial period. It became evident to me after repeated examinations of the condition of the structures of the neck in persons presenting themselves for treatment of ear or nose symptoms that a large percentage of aural patients

had visible enlargement of this organ. It was also discovered that nearly all these patients suffered from insomnia, and that the rapidity of the heart's pulsation was much increased, varying from one hundred to one hundred and forty beats a minute. Dr. Burnett,[1] of Philadelphia, has described cases of middle-ear disease in which he observed a concomitant enlargement of the thyroid gland, but he does not infer that they were related to each other.

From the conclusions deduced from my own observations a satisfactory explanation of one of the functions of the thyroid gland has been obtained. I consider this organ to be the centre of a nervous system which controls, through connections with the sympathetic ganglia and distant nerve centres by a peculiar inhibition, all the blood-vessels and the centre of the circulatory system, the heart itself.

The etiology of a permanent enlargement of the thyroid which has been described under exophthalmic goitre, but which is seldom, if ever, attended with protrusion of the eyes as given by De Wecker, I have translated as follows:

"Of the triad (of symptoms comprising the disease usually described as exophthalmic goitre) the most constant symptom is that which with few exceptions marks the onset of the disease (namely), that of palpitation of the heart and a noticeable exaggeration of its beats, which not infrequently go above a hundred, seldom above two hundred, or such a frequency which it is impossible to number. . . . The regularity of the impulses varies notably as well, either spontaneously without an appreciable cause, or under the influence of a light emotion, or from a slight effort.

"The second cardinal symptom, and in general a constant sign, is the enlargement of the thyroid gland which forms a goitre of mean dimensions and much less than the volume of epidemic goitres. The swelling is usually spread over the whole surface of the gland. When one side is favored it is ordinarily the right. . . . Ordinarily the swelling corresponds with an increase of the cardiac functions. . . . An anæmic state (chlorosis among women) precedes the development of the disease, anæmia, which in general usually

[1] Burnett, "Treatise on the Ear."

follows debilitating diseases, and above all a defective nutrition under the influence of prolonged emotions. It is for this reason that the term applied by Fercol of cardio-vascular ataxia is found justified, but not by the most frequent ending of this strange affection. It is essentially as a phenomenon of paralysis of the vaso-motor nerves and reduction of vessel-tone which the dilation of the vessels, principally of the carotids of thyroid and intra-orbital branches, is shown. It is the particular tendency to flushing, local sensations of heat, local perspirations, which would make a plea for paralysis of the sympathetic.

"M. Sattler thinks that the principal phenomena which are met with such constancy in the picture so varied in Basedow's disease, phenomena which partly show themselves in organs so remote, in a manner so unique, could be explained in admitting a lesion of certain centres which conduces to inhibition or a functional abolition of these centres, and, to express himself with more precision, he adds, of a lesion which reaches in the centre for the vagus, the tone regulator for the movement of the heart; there where the paths of conduction are not yet mixed up (with one another) and pass out from the centre; in other words, the lesion impresses the vaso-motor centre for certain regions of the body, especially those of the skin and of the head; finally, the centres for movements of coördination and of reflex action. . . . "

Subjoined are several cases illustrative of the condition in which a perverted function of the thyroid is frequently observed, and in which local manifestations appearing in the nose or ear make them of especial interest. The simpler forms of vaso-motor disturbance which are accompanied with functional derangement and enlargement of the thyroid gland readily demonstrate the relationship existing between this organ and the erectile structures within the nose.

A young woman of twenty, born of neurotic stock, is strong and apparently healthy, but has noticed for two years that the tip of her nose, more especially upon the right side, is quite noticeably red. Her right nasal fossæ are sometimes felt to be obstructed, though otherwise she complains

of no unusual symptoms. An inspection reveals a few papules and many dilated blood-vessels upon the surface of the nose. The right thyroid body is very much enlarged and appears as a distinct rounded swelling filling the lower half of the right side of the neck. This swelling is soft, compressible, and non-fluctuating. Examination within the nose reveals a right turbinate body which is very red, greatly enlarged, and sensitive to the touch. It is also noted that the heart's pulsations were regular, but more than normally rapid, — above one hundred a minute. Immediately upon making light pressure upon the enlarged thyroid there appeared upon the opposite side of the face and neck large circular spots, resembling the flush which comes by blushing, so numerous that the skin was almost completely covered. The pulse fell to fifty, the girl very soon said her sight was gone, and that she could not hear, symptoms of fainting from anæmia of the brain; but upon being assisted to a couch she quickly recovered.

A girl of seventeen who came to the Out-patient Department of the Boston City Hospital in the spring of 1890 had been neglected and was obliged to struggle for an existence. She was the subject of a chronic suppurative disease of the middle ear, during the progress of which there had occurred total destruction of the drum membrane. The drum cavity had become filled with granulation tissue and the auditory canal was always full of pus. After a long course of local treatment the suppurative process had stopped and the ear healed. Exposure in a storm, when the patient was very tired, brought on a severe "cold," the ear became painful, and she returned for advice and treatment. The auditory canal was then found filled with serum and mucus, the mucous membrane of the tympanum reddened and swollen, — evidences of acute inflammation. The nose was stuffed, the turbinates having become greatly swollen and inflamed. The thyroid glands were very prominent and swollen even across the isthmus. The pulse ranged between one hundred and twenty and one hundred and thirty. Patient appeared dull and listless, her countenance was pale, the extremities were cold, and circulation in the capillaries was very sluggish.

In this case treatment through the inactive thyroids by means of hot water applied upon towels stopped the pain, made an immediate reduction of the number of heart pulsations, while a second application of the water by the patient herself, on the next day, completely stopped the otitis, reduced the swollen turbinate to one-half its former size, the thyroid glands fully two-thirds, brought the pulse beats to normal, and restored the tone of the general circulation. The personal appearance of the patient had also greatly changed in that the dull and listless look had disappeared and her countenance had become bright and cheerful.

A woman, the subject of severe headaches, was visited when suffering with an attack of hemicrania accompanied with partial loss of vision (homonymous hemianopsia). A congestion at the base of the brain, possibly localized in the optic lobe, was diagnosed as the probable cause. Counter-irritation with ammonia water applied upon cotton was made under the corresponding mastoid process, upon the forehead at the supra-orbital foramen, and upon a spot in the neck where it was supposed that the thyroid body lay. In a few moments the vision became normal, the pain ceased, and, *mirabile dictu*, there was a noticeable enlargement of the lateral left lobe of the thyroid gland.

The direct effect of stimulation of the thyroid upon the circulation of blood in the nose, as well as upon the structures of the ear, is shown by the application of moist heat as in the cases here described.

Mr. T., who consulted me in October, 1892, for the relief of ringing in the ears and deafness, lived so far away that he was unable to have local treatment. I advised him to use hot applications on his neck for fifteen minutes every night before retiring. His right ear had begun to show evidence of disease during two years previous to his first visit, and his left ear had been deaf for ten years. There was constant tinnitus (ringing) in both ears. The appearance of the membranes, their transparency, suggested fixation of the joints of the ossicles, and tests confirmed this mechanical condition. There was hypertrophy of the turbinates in the nose. Treatment at home, with the hot-water

applications to the thyroids, was continued for six weeks before the patient reapplied for local treatment. The tinnitus had ceased in the right ear. Local applications to the nose with catheterization of the left Eustachian tube later, together with the daily use of hot water, finally restored both ears, so that upon the return of the patient from a three-months' sea voyage, about ten months later, he was discharged cured.

A young, vigorous man, who was accustomed to the dangerous occupation of chimney building, and had recently assisted in the construction of a church tower, applied to me for advice regarding attacks of deafness and dizziness, which seemed dependent upon congestion of the labyrinth. Naturally enough, this patient was much concerned about himself, and came for treatment soon after his first attack. He received immediate relief by the use of hot water applied to the thyroid glands, and a few doses of strychnine sulph. completed the cure.

Of chronic middle-ear diseases so frequently accompanied with enlargement of the thyroid gland and derangement of its function as to attract the attention of the observing aurist, and of a character usually suggesting a very unfavorable prognosis as regards curability or relief, is that variety called "insidious" or sclerosed (otitis media catarrhalis chron. interstitialis insidiosa). The prominent aural symptoms of this disease are deafness and subjective noises — most frequently of a low-pitched sound, described as roaring. In a small per cent. of cases of this type the patients also make complaint of hearing high-pitched sounds or hissing noises besides the roaring.

In only a very small proportion of cases one finds, upon examination with the speculum, enough thickening of the membrana tympani to allow him to conscientiously say that it is opaque. In many instances where it may have been so considered the clearer illumination or the better focussing of the light reflected from the deeper structures of the tympanum will determine it to be transparent. This statement is made because many text-books upon the ear as well as some prominent teachers neglect to speak of the physical

appearances, or assert and insist that there is a process of thickening of the intra-tympanic structures (mucous folds, capsular ligaments or lining of the attic) which, in time, will show itself by descending or extending into that part of the tympanum visible to the eye, and will thus prove the theory of "sclerosis" or adhesive inflammation of the tympanum.

The uselessness of trying to explain the causation of the pathological or disturbed physiological state of the sound-conducting apparatus by such a hypothesis, is conclusively shown by comparisons of the records of appearances in certain cases when the symptoms have been present for many years, or where the memory of intelligent patients retains the evidence of previous examinations, or the date when attention was first called to the state of their ears. In other words, a transparent membrane once found in an ear with progressive deafness always remains transparent.

The normal state of health supposes a cerebro-spinal system of nerves keeping under control and modifying, in the varying conditions of the economy, all unconsciously to the organism, a sympathetic system of nerves and ganglia. These in turn, acting upon the organs, maintain a functional activity to which we give the name of life. When from any cause there has been a greater expenditure of nervous force than can be restored by ordinary rest in sleep, the sympathetic system becomes stronger than the cerebro-spinal, and, for the time, rules the organism, and we see its power in the changed physical appearance or psychical behavior of the individual. The cheeks become flushed, the breathing sometimes gasping, the patient looks tired, and though at first mentally excited, being talkative and vivacious, soon becomes inattentive and irritable, or dull and sleepy.

In consequence of this imperfect inhibition of the sympathetic system the tissues within the nose, especially of the lower turbinate bodies, become engorged with blood, and, aided by the exudation of a glutinous kind of mucus, mechanically produce a closing of the ventilating shaft of the tympanum (the Eustachian tube). With the accompanying

stasis of the circulating fluids in these parts and infiltration of the tissues there may follow atrophic changes and the power to open the tube, formerly resident in the muscles, is thereby lost.

These cases may be briefly described as most frequently occurring in women, or in men whose nervous organization and physique resemble those of women. They are found as well among male patients whose occupation or employment has brought on a certain neurasthenic state in consequence of accompanying anxiety or mental worry.

In neurotic subjects or in those exhausted by work, worry, or debilitating diseases, then, there are to be discovered, either by direct examination or by historical account, certain disturbances in the function of hearing by which the patient becomes conscious of the loss of the lower tones of the musical scale, and perceives that the ability to hear conversation is gradually disappearing. There is heard a roaring or rushing sound in the head, and fatigue increases these symptoms many fold.

Visual examination of the ear in these cases shows nothing abnormal except a depression of the membrana tympani and, perhaps, a slight injection of the vessels of the manubrial plexus.

The nose, as just stated, is never found normal, for one always sees much posterior hypertrophy with the turbinate bodies engorged with blood. The thyroid gland is usually found swollen, though not, as is generally supposed, at its traditional situation upon the trachea but to the side and beneath the muscular tissue of the sterno-cleido-mastoid, low in the neck in front.

The result of continued closure of the Eustachian tube upon the sound-conducting apparatus of the ear can best be studied in connection with the description of the anatomical arrangement of the chain of ossicles in Helmholtz's[1] work on tone perception:

"The joint between anvil and hammer is a curved depression of a rather irregular form, like a saddle. In its action it may be compared with the joints of the well-known

[1] Helmholtz, "Tone Perception," Ellis, p. 133.

Breguet watch-keys, which have rows of interlocking teeth, offering scarcely any resistance to revolution in one direction, but allowing no revolution whatever in the other. Interlocking teeth of this kind are developed upon the under side of the joint between hammer and anvil. The tooth on the hammer projects towards the drumskin, that of the anvil lies inwards; and, conversely, towards the upper end of the hollow of the joint, the anvil projects outwards and the hammer inwards. The consequence of this arrangement is that when the hammer is drawn inwards by the handle, it bites the anvil firmly and carries it with it. Conversely, when the drumskin, with the hammer, is driven outwards, the anvil is not obliged to follow it. The interlocking teeth of the surface of the joint then separate, and the surfaces glide over each other with very little friction. This arrangement has the very great advantage of preventing any possibility of the stirrup's being torn away from the oval window, when the air in the auditory passage is considerably rarefied. There is also no danger from driving in the hammer, as might happen when the air in the auditory passage was condensed, because it is powerfully opposed by the tension of the drumskin, which is drawn in like a funnel. . . .

"Since the attachment of the tip of the short process of the anvil lies sensibly inwards and above the ligamentous axis of the hammer, the head of the hammer separates from the articulating surface between hammer and anvil, when the head is driven outwards, and therefore the handle and drumskin are driven inwards. The consequence is that the ligaments holding the anvil against the hammer, and on the tip of the short process of the anvil, are sensibly stretched, and hence the tip is raised from its osseous support. Consequently in the normal position of the ossicles for hearing, the anvil has no contact with any other bone but the hammer, and both bones are held in position only by stretched ligaments, which are tolerably tight, so that only the revolution of the hammer about its ligamentous axis remains comparatively free. . . .

"But a more important circumstance, as it seems to me, is the loose formation of the joint between the hammer and

anvil. If the handle of the hammer is driven inwards by the drumskin, the anvil and stirrup must follow the motion unconditionally. But that is not the case for the subsequent outward motion of the handle of the hammer, during which the teeth of the two ossicles need not catch each other."

We see that the normal condition of the joints between the first two bones permits of the passage of low sounds of long wave-length when the degree of tension of the joint is not excessive, *i.e.*, when the air in the tympanum is not rarefied and the membrana depressed. When this is the case, however, the joint transmits as if the two bones were one, and they are therefore acting as a damper to many (all) tones. This may be easily tried in normal ears by the act of swallowing with the nostrils closed.

The rarefaction of air within the tympanum has caused the membrane of the drum to be pressed more deeply inward than normally, and the malleus and incus, or malleus, incus, and stapes become more or less firmly driven together. In the early stages of "sclerosis" the deafness for low tones only would point to the locking of the first joint in the chain of ossicles. The indrawn handle of the malleus allows a retraction of the muscular fibres and tendon of the "tensor tympani" and wasting of its fibres may supervene. The stapedius muscle also becomes similarly affected, and its function, that of preventing too much pressure of the foot plate of the stapes against the membrane of the oval window, is interfered with or abolished.

I have had a patient under observation, in whom this mechanical affection of the auditory apparatus had produced marked deafness, which was at times thoroughly self-appreciated because, when gaping, she could hear so much better that it seemed as if hearing had been suddenly restored to her. It may be supposed that a contraction of the stapedius muscle simultaneous with the act of gaping lifted out the last bone of the chain, to permit sound vibrations to reach the cochlea.

We have already stated it as a fact, that these patients most commonly hear the higher tones of the scale, the sounds of short wave-length, and lose those of low pitch or long

wave-length. They hear the conversational tones of children and women, but not those of men.

The proof of this inability to hear low tones is best demonstrated with a series of tuning-forks pitched to the lower tones of the musical scale. I have a few such tuning-forks which were made for me by Hajek, of Vienna. In making use of these Austrian forks for testing purposes I dispense with clamps and hold each fork with finger and thumb at its node, in this way causing the fork to send forth its fundamental tone when struck. Some patients entirely lose the power of distinguishing one tone from another, while others miss single tones from the scale. The highest tones of the fork or voice are always heard unless there is absolute deafness.

Ears vary so much in sound-conducting power that, in spite of the dictates and usages of high authority, as well as recommendations of such special committees as have considered this question of the means for testing hearing, I long since gave up doing more than making relative comparisons with what is supposed to be the normal hearing. The ordinary manner of testing the hearing of ear patients with one's voice, Politzer's acoumeter, watch, and tuning-fork is open to grave criticism from those who wish to be in a slight degree scientifically accurate. None of those can be considered reliable for purposes of comparison by different observers. No two human voices are alike in power or tone. Acoumeters are not constructed alike even though careful directions were given by Politzer, and, even if all were equally tuned, we should have but one sound and that not a pure tone. With far greater weight will objections hold against the watch. An ideal instrument is not owned by any aurist, and, indeed, the only instrument in the world from which we could ever expect scientific results is still unfinished in Paris, a tonometer, to give all the tones perceptible to the human ears. It is not supposed that even the most ambitious of ear doctors will ever possess this, but it seems to me that a tonometer of moderate dimensions would be a great acquisition to our stock of instruments, and with the advanced state of knowledge of physics in America our

aurists should not rest satisfied until provided with improved instruments of precision.

I now make a *résumé* of the principal statements comprised in this article in order to more concisely explain this somewhat obscure subject.

Cases of progressive disease of the ears, occurring in patients whose nervous organization is not normal, and who usually complain of hearing roaring or ringing noises, whose ears upon examination with mirror and speculum present slight alterations, are found to have lost the power of hearing the lower tones of the musical scale. Among these cases a large percentage have a noticeable enlargement of the thyroid gland, and all have swelling or hypertrophy of the turbinate bodies. The displacement of the malleus and locking of the malleo-incudal joint, brought about by the closure of the Eustachian tube in the consequence of the lack of inhibitory action upon the turbinate body by the thyroid gland is, in the early stages of these affections, the cause of the impairment of hearing. In the later stages of the disease a fixation of the other ossicles takes place until the stapes finally becomes firmly set in the niche of the foramen ovale, thus producing almost complete loss of sound conduction.

I here purposely omit more than a reference to the neurotic element which enters so fully into these cases and which explains the inability of many patients to use their ears for any length of time without exhaustion.

VIII.

TUBERCULOSIS OF THE BLADDER — ITS APPEARANCE AND TREATMENT THROUGH THE KELLY CYSTOSCOPE; WITH A REPORT OF CASES.

By Edward Reynolds, M.D.

The recent development of an easy and satisfactory method of exploring the bladders of women directly, and of examining the urine from each kidney separately, bids fair to rapidly extend our knowledge of the genito-urinary tuberculosis of women, and may possibly make direct surgical treatment, for women at least, somewhat more promising than has heretofore been thought possible. We are now able, in women, to locate the seat of the disease with accuracy, and, so far as the bladder is concerned, can, moreover, avail ourselves of direct local treatment of the lesions. During the year 1895 it was my privilege to see, in the Out-patient Department of the City Hospital, four cases of vesical tuberculosis. In three of these cases it was fairly probable that the bladder was the primary seat of the disease: in the fourth it was secondary to a tuberculosis of the kidney. In two of the cases a microscopical diagnosis was unattainable, but the clinical aspect rendered tuberculosis probable: the other two were diagnosed by the pathologist as well as clinically, and were followed up for a prolonged period of time.

The number of my cases is but small, yet the scarcity of the literature of the subject makes me think that observations made upon even this small number of cases may be worth reporting; for although a few cases of tuberculosis of the bladder have been reported in which this method was practised, I have failed to find in the Index Medicus any paper which gives either a detailed description of the appearance of the lesions, or an account of even a single case which has been followed up by direct inspection for more than a few weeks, and I am assured, by a letter from

the Surgeon General at Washington, that no such paper has been written since the publication of the Index ceased.

Case 1. J. L., unmarried, entered the medical wards of the Boston City Hospital, service of Dr. Withington, on March 12, 1894. Her family history was negative. She was suffering from occasional sharp attacks of paroxysmal pain over the region of the right hip. Micturition was frequent, at times almost incessant, and attended by some scalding. There was a well-marked evening hectic. The urine was variable in quantity, and normal on chemical examination; there was a considerable sediment, composed mostly of pus and small round cells, with considerable normal and abnormal blood, and occasional hyaline casts. Palpation of the kidneys was negative. On April 7, however, immediately after an attack, the right kidney showed slight tenderness on palpation, and Dr. Withington was inclined to believe it slightly enlarged. A diagnosis of tuberculosis of this kidney was then thought probable, but not established. On May 5 I saw her for the first time, at Dr. Withington's request. On bimanual examination, the genital organs were normal; the bladder was perhaps a little thickened, but not tender. On examination with the cystoscope under ether, four or five recent ecchymotic spots were seen upon the posterior wall, each surrounded by an injected area. There was one circular ulcer, about half the size of a split pea, near the centre of the trigonal region, and almost every part of the bladder wall which was seen was covered with minute, glistening white specks (the light was very unsatisfactory at this examination, and it is probable that the white specks seen were the minute bits of mucus, or muco-pus, which are not uncommonly seen in inflamed bladders). The single ulcer which was seen presented a pale gray surface, with slightly raised and reddened edges, and was thought to be probably tubercular. On April 12 the patient was again examined with the cystoscope without ether, in a better light; and on this occasion, in addition to the ulcer before described, three small, pale, raised papules were detected just behind and outside the right ureteral orifice. The ecchymoses before noticed had

disappeared. A cotton swab was passed lightly over the ulcer, and submitted to the pathologist for microscopical examination, but the result was negative. During the next three weeks the ulcer and papules were touched every second day with a 10-grain solution of nitrate of silver, but as I had not at this time learned the tolerance of the bladder for stronger applications, but little effect was produced. The patient left the hospital and was not seen again until Feb. 2, 1895, when she appeared at my office, with the statement that she had been fairly well in the interval, and had been at work as a domestic until the week before, but had then been compelled to throw up her place, on account of an increasing frequency of her desire to micturate, which had of late become almost constant. She was much emaciated, and was evidently in an advanced stage of tuberculosis. She was referred to the hospital, and on February 5 I examined her with the cystoscope, when a few small ulcers and a large number of papules were found occupying the trigonal region. A swab was passed over this portion of the bladder and submitted to Dr. Ogden, the assistant pathologist to the hospital, who reported the presence of numerous tubercle bacilli. On the 12th one of the ulcers was touched with the solid nitrate of silver; on the 14th three more ulcers were treated, those which were nearest to the ureteral orifice being selected for the initial attack, and the bladder being insufflated with aristol after each treatment. The patient was put upon cod-liver oil and iron. On the 26th the sites of the four ulcers first treated were covered by healthy mucous membrane, and several others which had been touched in the interval were in the process of cicatrization. The urinary symptoms were even then much relieved, but the lungs were already invaded, and the patient, being destitute, was unable to continue treatment, and was sent to Tewksbury, where she undoubtedly succumbed to her disease.

Case 2. Mary F., a widow thirty-six years old, of negative family history, appeared at the City Hospital on Dec. 15, 1894. She complained of a bearing-down pain which was greatly relieved by micturition, and of a very frequent

desire to empty her bladder. She was rather pale, but fairly well nourished, and thought herself well, apart from these rather trying symptoms. On bimanual examination of the pelvis, the uterus was found in the second degree of retroversion, very slightly enlarged, movable, and non-tender. (It may be remarked in passing that treatment of the retroversion had no effect in alleviating her symptoms, and that the retroversion itself proved to cause no symptoms when the bladder was normal.) She was examined at her first visit by the cystoscope, and the bladder was found to be normal with the exception of two small, glistening, rounded papules, one of which was situated immediately behind the internal opening of the urethra, near the median line, and the other somewhat behind this and to her left. Both papules were touched with a swab moistened in a solution of nitrate of silver, twenty grains to the ounce, and the whole bladder was insufflated with aristol. This treatment was repeated a number of times between this date and January 10, without any apparent effect upon the papules, which steadily increased in size and elevation. Both were, at the first visit, about the size of a grain of rice, slightly oblong, and by the end of the first week in January both had become about double their original size. On January 10 the anterior papule persisted, but the site of the posterior one was occupied by a slightly excavated grayish ulceration of about the superficial area of the papule which had preceded it. On January 12 the top of the anterior papule was seen to be ulcerated. In the ten days between January 5 and 15 the strength of the nitrate solution was repeatedly increased, until on January 15 both the ulcers which occupied the position of the former papules, and were now surrounded by injected areas, were touched with the solid stick of nitrate of silver. Before this was done a scraping taken with a flattened wire from the surface of both ulcers was submitted to Dr. Stokes, the resident pathologist of the hospital, for microscopical examination. His report stated, "Nothing of diagnostic interest found." From this time on, each ulcer was, as a rule, touched three times a week with the solid stick of nitrate of silver. At the end of three weeks the

posterior ulcer was represented by a normal cicatrix. The anterior ulcer was cicatrized, but showed several slightly elevated spots along its circumference. These elevated spots went through the same course which had been observed in the progress of the original papules, and on March 1 the resulting ulcers were recauterized as before. This spot was finally completely healed on March 20. On February 5 a new papule with injected summit was discovered just inside the internal orifice of the urethra, was treated as the others had been, and like them was healed in about three weeks. On February 20 Dr. Ogden reported that a specimen of urine submitted to him a day or two before contained tubercle bacilli. This was the only positive result, and was obtained after repeated negative examinations by Dr. Ogden. On February 23 Dr. J. L. Morse examined the lungs and reported them sound. Between March 7 and April 4 five suspicious papules were detected on various parts of the trigonum, were treated as the others had been, and healed with about the same rapidity. On April 20 a careful and prolonged examination of the bladder resulted in the detection of no abnormalities, except that the site of most of the ulcers could be recognized by the presence of a white cicatricial spot surrounded in some cases by a reddened area. All the symptoms had disappeared. The patient returned for observation at increasing intervals, but remained wholly well until on November 30, after an absence of two months, she returned with the statement that she had noticed a very slight increase in the frequency of her desire to urinate. Nothing was found in the bladder at this examination, but two days later a small oval, pinkish papule was discovered, just above the internal orifice of the urethra, having probably been missed at the last examination. After firmly cauterizing this papule with a blunt solid stick of nitrate of silver, the point of which was of somewhat larger area than the papule, I was surprised to find that not only had the papule disappeared, but at the centre of the cauterized spot was a small circular excavation of less than half the size of the papule. This change suggests the question of whether the papule was not in effect a pustule covering an already

developed ulcer of small size, and this question will be referred to later in the paper.

The history of the case, during the next six weeks, may be summarized by saying that although each lesion that was treated healed after from one to three treatments, new papules constantly appeared. On January 2 the bladder appeared to be wholly normal, and there were no urinary symptoms; but a week later several new papules had appeared in the neighborhood of the right ureteral orifice, and with them there was a reappearance of the frequent and teasing desire to urinate. At the present date of writing, January 22, the new group of papules bids fair to disappear, and the urinary annoyances are very slight.

This case has, at all events, had her disease arrested for a full year by treatment, and has had eight months of freedom from urinary symptoms. Whether she is eventually to succumb to the disease or not remains to be proved, but from the situation of the recent papules above the orifice of the right ureter and the persistence of the tendency to recurrence, I am afraid that the kidney has become invaded, though its palpation is as yet negative. It is, however, only fair to say that she is a widow in poor circumstances, obliged to support herself and child, that her surroundings have been anything but favorable to a phthisical subject, and that she has in fact been almost entirely deprived of the hygienic treatment which we must all concede to be of more importance than any local care. The case seems to me to argue strongly for the advisability of local treatment.

[At date of publication this patient is again wholly well.]

Case 3. M. F., of consumptive family history, came to the hospital on May 14, 1895, complaining of frequent micturition accompanied by burning, both symptoms of about eight weeks' duration. The uterus was movable and of normal size. There was a celiotomy scar in the abdomen, and the patient stated that her ovaries had been removed two years before. On May 18 a satisfactory examination of the bladder was obtained, and three small, rounded elevations, precisely similar in appearance to the papules seen in the two preceding cases, were found on the posterior wall

of the bladder, just inside the internal orifice of the urethra. A little mucus was scraped from the bladder wall, but neither in this nor in a number of subsequent examinations of the urine was Dr. Ogden able to detect tubercle bacilli. The solid nitrate of silver was at once applied to both papules, and the bladder was insufflated as usual. On the 21st two of the ulcerations resulting from cauterization were healthy in appearance; the slough adhered to the third, and its edges were still elevated. It was accordingly re-cauterized. On June 1 two ulcers had cicatrized, and the third was almost normal in appearance, but was again touched with the nitrate stick. On June 11 the patient was examined by Dr. George Haven, who succeeded me in the service: he detected only some injected patches on or about the sites of the former ulcerations. The bladder was insufflated with aristol, and on June 27 she was referred to the medical out-patient department with a normal bladder, and in the absence of gynecological symptoms. She did not visit the medical department, and has not returned to the gynecological clinic. Her relief from a distressing symptom had been so prompt and complete that I think her failure to return argues strongly for her having remained free from trouble.

Case 4. C. R., of phthisical family history, came to the hospital on June 1, the last day of my service, complaining of much burning on micturition, and of an inability to retain her urine for more than a few minutes. On examination of the bladder, two papules, exactly similar in appearance to those observed in the other cases, were found close to the internal orifice of the urethra, and were touched with the nitrate stick. On June 4 they were retouched by Dr. Haven. Unfortunately, no examination for bacilli was made on either occasion. The urinary symptoms disappeared within a few days, and although she was under regular treatment in the clinic for other pelvic conditions for some time, the records make no further statements of the condition of the bladder, nor are any urinary symptoms referred to. In the absence of any complaint on her part of the reappearance of the symptom which was most prominent when she

came to the clinic, it is perhaps fair to assume that she was, at least temporarily, completely relieved.

In summing up the results of the cases reported, we see that the relief of the symptoms was in every case so prompt, marked, and undoubted as to require no extensive mention. The value of the method in affording us a means of early diagnosis is upon the whole almost as plain; but there are certain points, both in the technique of direct inspection as applied to tuberculosis, and in the light which this method throws on the vesical symptomatology, which I think will bear a little further discussion; and after that I may perhaps be justified in offering a preliminary consideration of the probable value of the cystoscopic treatment in the curative management of the disease.

In the study of the diseases of the bladder one learns early that the appearance of the lesions seen varies so widely in accordance with the variations in the intensity and direction of the light, and with variations in the degree of the moisture of the surface, that it is necessary to use great caution and to take repeated observations of any lesion before permitting one's self to form a final interpretation of the meaning of the appearances which it presents. Any one can see with ease the posterior wall of the bladder; and the art of obtaining a full distension of the viscus, of recognizing the ureteral orifices, and of distinguishing the location of a lesion in the bladder, is easily learned after a sufficient amount of practice; but even after this art has been acquired, the same lesion may vary so much in appearances at different sittings, or even in different portions of the same sitting, that a judicious observer will insist upon obtaining the same appearance of a given lesion under varying conditions of light before allowing himself to determine finally upon its character. In the observation of tubercular lesions there are, moreover, certain inherent difficulties which do not apply to all diseases of the bladder. In inflammatory vesical disease of any moment, the diseased appearance is likely to be so widely diffused that the presence of an abnormality is apparent at the first glance into the bladder, but tubercular lesions are seldom surrounded by inflammatory patches

of any size, and the whole abnormality is therefore likely to be of such small size as to be easily overlooked, even in the more accessible regions of the bladder. They are, moreover, often found in the regions laterally external to the ureteral orifices; or just inside the internal orifice of the urethra, upon that portion of the mucous membrane which recedes abruptly from this opening: and both of these are localities in which small abnormalities are to be detected with considerable difficulty. We must therefore remember that we can exclude vesical tuberculosis only by a most thorough and methodical search of the bladder: and genito-urinary tuberculosis in general only by the discovery of some other cause for the symptoms. Two points should, however, raise a suspicion of concealed tubercular lesions in a normal-looking bladder. First, the presence of a small quantity of blood and pus in the urine on microscopical examination of the sediment, in connection with the presence of a frequent and teasing desire to urinate and with the absence of any inflammatory irritation about the trigonal region: and in the absence, moreover, of any abnormality which could account for the pus in the urine of either kidney on catheterization of the ureters. Second, the presence on a *normal mucous membrane*, of numerous white spots which can be cleansed from its surface with a swab, and which probably consist of small flocculi of muco-pus, such as are constantly seen in *inflamed bladders*, without tuberculosis.

The generally accepted statement that the presence of blood and pus in the urine is characteristic of genito-urinary tuberculosis perhaps deserves a more than passing mention. The presence of blood and pus in quantity is symptomatic, not so much of tuberculosis, as of an active inflammatory process, *per se;* but the presence of small quantities of these substances in cases in which the other symptoms of inflammation are absent, and especially when the symptomatology consists in a constant desire to urinate, relieved by micturition, and without pain during the act, is symptomatic of early tuberculosis: more especially when numerous minute blood-clots are occasionally discovered in the urine. An explanation of the frequent presence of

microscopic clots in the urine in the early stages of genito-urinary tuberculosis may possibly be offered by the peculiar behavior of one papule under the application of nitrate of silver, which was noted in the description of the second case. Should further observation prove that the ulcers are habitually formed by the bursting of pustules which roof in the already developed ulcers, the clots might well be supposed to be due to minute hemorrhages developed during this process.

The directions in which this advance in our methods of dealing with genito-urinary tuberculosis may reasonably be expected to give us practical aid are by enabling us to obtain a diagnosis at an earlier stage of the disease than was formerly possible, and perhaps by directly increasing our surgical control of this affection.

The diagnosis of the disease has hitherto rested wholly upon the urinary and constitutional symptomatology of tuberculosis, together with such information as can be obtained by repeated microscopical examinations of the urine for the tubercle bacilli. The most distinctive urinary symptomatology has been already spoken of, but every one recognizes the fact that these symptoms have always been but an imperfect guide in the differentiation of an attack of tuberculosis from the inflammatory diseases of the bladder. The constitutional symptoms of tuberculosis only appear after the disease has reached a somewhat advanced stage; and the bacteriological examination of the urine is admittedly uncertain even in the presence of advanced disease.

The diagnosis of this disease without direct examination of the urinary organs is, then, at best, a very blind one until the constitutional symptoms have become well developed, and in the majority of instances it is then too late to hope for any radical results. The question then arises, How far will the direct inspection of the bladder aid us in obtaining the early diagnosis of the disease which alone can offer any prospect of a cure? The answer must depend upon the localization of the lesions in the individual case.

When the tuberculosis is primary in the kidney, and the secondary invasion of the bladder is slow in making its

appearance, the only aid which the cystoscope can give us is by enabling us to isolate the urine from each kidney for a separate examination; but the possession of the knowledge that the blood and pus detected in the urine came from one kidney only, and from no other source, might well be sufficient to render a doubtful clinical diagnosis more than probable. Moreover, the first case detailed shows that a secondary invasion of the bladder may have occurred at an early stage of the disease, and that a positive diagnosis can sometimes be made by the cystoscope at a time when the medical clinician is still in doubt.

In cases in which the disease is primary in the bladder, and also in those in which the vesical invasion is so early as to be almost coincident, the method will permit of a probable diagnosis from the moment when the first papule appears, and of a positive diagnosis so soon as it has ulcerated. At least, it seems to me to be a fair position to say that when a suspicion of tuberculosis has been excited by the existence of a frequent and teasing desire to micturate, and by the presence of a little blood and pus in the urine, if on cystoscopic examination we find the characteristic papules and ulcers of the bladder, the diagnosis is assured: if papules only are found, the diagnosis is probable, but it is perhaps best to watch the case for a few days or weeks, in order to obtain an assured diagnosis before beginning local treatment. This seems to me to be not too strong a position to take, because the experience which I have quoted above leads me to believe that a negative microscopical examination of the secretion obtained by brushing a swab directly over the affected surface is but little more valuable than the ordinary examination of the urine; yet this examination and that of the urine should of course always be made, and made repeatedly, in view of the fact that while its negative results are valueless, a single positive result may afford a positive diagnosis.

I think, then, that we may conclude that the cystoscopic method of examination will be of great assistance to us in the early diagnosis of tubercular conditions, and will for this

reason indirectly improve the prospect of a cure by ordinary medicinal and hygienic treatment.

I think, too, that even from the results of these few cases we may postulate the position that local treatment is of great value in the palliative relief of symptoms; but the question of whether it is likely to prove of permanent curative value is, it seems to me, a matter for separate consideration, and one which can be determined only by a careful consideration of the nature of the disease, and a study of its natural history under ordinary medicinal treatment.

We are all only too familiar with tuberculosis of the lungs. We all know that for the control of that form of the disease we must depend wholly on the nutritive tonics, on alteration of climatic surroundings, and perhaps on the newly introduced tuberculin. We all know, now, that the common glandular abscesses which were long considered the outcome of a strumous diathesis are, in the majority of instances, a localized tuberculosis: and we know, too, that with proper surgical and hygienic care the tendency of these cases is towards recovery, without general infection of the patient; *i.e.*, that in these forms of tuberculosis the local treatment is of perhaps as much importance as the constitutional. The question with which we are now concerned is, With which form shall we class genito-urinary tuberculosis? It is my opinion that we must assign this form of the disease to a position between the two classes of which we have just spoken.

We know that genito-urinary tuberculosis is like the pulmonary form of the disease, in that it is a tuberculosis of a mucous membrane; and that it is like it, too, in the fact that its tendency is towards a fatal ending; but it is unlike tuberculosis of the lungs in that its progress is less rapid, that it tends to remain localized for a long time, and that when unilateral, as it usually is, it commonly begins in an organ which can be extirpated by the knife (or in the bladder which is still more accessible). We know that there are instances of permanently successful nephrectomy for tuberculosis, and that in the unsuccessful cases the recurrence has usually been localized in the bladder. Is it

not then possible that in some, at least, of these failures the extirpation of the disease was not complete, because there was at the time of the operation a coincident invasion of the bladder (as in the first case here reported); and is it not possible that if a subsequent local treatment of the bladder had been instituted, some of these failures might have turned out successes?

These are, however, only speculations which must be left to the verdict of a wider experience, but the conclusions at which it seems to me that we are already warranted in arriving are: First, that when a suspicion of genito-urinary tuberculosis arises in a female, we fail in our duty to our patient if we do not subject her to a searching local examination of the urinary organs. Second, when a diagnosis has been made in the early stages, we should at once institute the most thorough course of constitutional treatment which the situation of the patient renders possible, in combination with a prompt local treatment of any accessible lesions. Third, that with the early diagnosis which the use of the cystoscope makes possible, an early cure of the vesical lesions by local treatment may yet enlarge the field for nephrectomy. Fourth, and most important, that local treatment affords a most surprisingly rapid means of alleviating distressing symptoms which have remained unaffected by medicinal treatment, and that this is true even in cases in which all hope of a cure must be laid aside.

IX.

INTRAOCULAR HEMORRHAGE DURING OR SHORTLY AFTER CATARACT EXTRACTION.

By Edwin E. Jack, M.D.

The following case occurred in my spring service at the hospital last year.

The patient was a man, aged seventy-two, with good family history. "Always well and strong," though now seems rather feeble. Chronic alcoholic. Heart normal: urine, no albumen or sugar. Temporal and radial arteries apparently sound. Ten years ago an attack of conjunctivitis; twenty-five years ago operated on for varicose veins of leg, and ten years later for broken ribs. The right eye was hit years ago by a clinker, the sight being lost at the time, subsequently partially regained, and later slowly faded away, till perception of light only remained. The lens was cataractous and dislocated upward and outward, leaving about half the pupillary area free. The perforating veins were prominent, but not abnormal. The disc was atrophic, and most of the vessels emerged at the nasal side, giving the effect, at first sight, of a glaucomatous cupping; there was no sharp dipping of the vessels, however. There was pulsation in one of the lower veins. The whole disc was bluish-white and slightly excavated, and there was, beside, a choroidal ring. The tension was not abnormal. The appearances, except for the atrophy, were not unusual for the age of the patient, though at first strongly suggesting glaucoma. Dr. Wadsworth, who saw the patient, concurred in this view. The left eye had a mature cataract, the history of which extended over two years. Perception was good, but projection a little faulty, attributed in part, perhaps wrongly, to the patient's hebetude.

On the 29th of May, I extracted the cataract in the left

eye. Four per cent. cocaine was used several times, and then an incision was made upward at the corneal margin, involving one-third of the circumference. When the section was finished, the patient began to be a little uneasy, though he said nothing. A small iridectomy was made upward, the iris tending to prolapse. I noticed that the slight dents made in the ball previously by the speculum had now disappeared, and the globe seemed tense. Immediately after capsulotomy, soft cortical, of which there was considerable, was pressed out without any interference, and after it the whole lens, to be followed immediately by large quantities of normal vitreous. The speculum, at the first sign of trouble, had been lifted from the eye. At the time of the first expulsion of cortical, the pain in and around the eye became excessively severe, and a subcutaneous injection of morphia was given. After a while some of the protruding vitreous was cut off. The suspicion of intraocular hemorrhage came with the first unusual behavior of the eye, and at the end the diagnosis did not seem to me at all doubtful, though no blood had made its appearance. It was a question then whether to enucleate the eye or not. On account of the non-appearance of blood, it was decided to bandage the eye and wait. A sterile binocular bandage was applied. During that day and night the patient continued to have pain, which was relieved by frequent doses of phenacetine. The bandage was reapplied the next morning, because it had become loosened and displaced by the patient's movements. The second night was a fairly comfortable one, as were also the next few days, the bandage being changed once in a while when displaced. On the eighth day the dressing was omitted. There was considerable pain, and the globe was much injected. On the tenth day the condition was this: eyelids and conjunctiva slightly œdematous, a good deal of injection, and a constant discharge of mucopus. Anterior chamber present but shallow, the upper part filled with cortical mixed with pus. Wound widely gaping and occupied by a projecting mass, as large as a small cranberry bean, of vitreous mixed with pus. At the nasal side of the wound a smaller mass of clear vitreous. No percep-

tion of light. For the last few days the pain had been constant, but was relieved by phenacetine and morphia. On account of the prospect of continued pain and probable panophthalmitis, enucleation was proposed and readily accepted. It was done on the tenth day, and was interesting because of the free hemorrhage after cutting the optic nerve and larger vessels. Immediately after removal of the globe the lids were thrust forward, and made tense by the blood behind. Very little escaped, however, the lids acting as a valve. Iced compresses of 1-5000 corrosive were used continuously. There was some pain after the operation, which required morphia for its relief; but the patient was soon comfortable, and remained so till his discharge on the twentieth day.

The eyeball was put into formalin, and after hardening, I cut the globe in halves longitudinally. From one half, sections were made by Dr. Stokes and examined by Dr. Councilman, whose report is here given. I am indebted to both these gentlemen.

"The eye, after hardening, is greatly shrunken. The cornea is drawn in sharply in the middle. The retina is detached over its entire extent, and in some places is driven forward and adherent to the cornea. The iris is adherent to the cornea and is in places converted into hyaline tissue. Almost everywhere the choroid is detached with retina. There is an extensive hemorrhage everywhere in the eye. It is found between the sclerotic and detached retina and choroid, and involves all portions of the eye not filled up with crumpled choroid and retina. In places there is a beginning organization in the mass of blood. The blood-vessels in the sclera and other parts of the eye show no abnormal condition."

Dr. Wadsworth has kindly given me permission to speak of two similar cases which he has had, both in the City Hospital, the first of which I witnessed. A man, aged forty-five, had mature senile cataract in the left eye. He had always been well and strong. The right eye was normal, with good vision. The sight of the left had been failing for a year. There was the history of a blow on this eye

some years before, but the injury had not troubled him any. Little attention was paid to this, as cataract patients are so apt to attribute their trouble to some trivial cause. The perception and projection were good, tension not abnormal. "Simple extraction" was done. The section was made and the lens removed without difficulty: the speculum had been removed after the completion of the cut. Almost immediately after the escape of the lens, while the eye was still open, there was a sudden prolapse of iris with very great pain. The lids were closed, but there followed almost immediately a large gush of semi-fluid vitreous: this was quickly followed by more, and this again by a stream of blood which flowed down the cheek. The condition of affairs was made known to the man: enucleation was advised and accepted, and done immediately. He was discharged on the twelfth day.

Another patient of Dr. Wadsworth's was a man aged eighty, who had been coming for a long time to the out-patient department with slowly maturing cataracts. During this time he had been repeatedly examined, and aside from the lenticular opacity, the eyes had appeared normal. After an interval of several months a rather hasty examination showed the cataracts mature. He was admitted to the house and etherized. When the speculum was introduced, Dr. Wadsworth noticed that the perforating veins in that eye were larger than usual. Almost immediately after the corneal section was completed a small thread-like stream of blood was seen to flow upward across the lens from behind the iris at the lower border of the pupil, followed soon by larger and larger quantities, which caused prolapse of the iris and gaping of the corneal wound. The eye was bandaged and subsequently atrophied. Some months later it was found that the other eye, which had previously had good perception of light, was sightless. The cause could not be ascertained on account of the inability to see the fundus.

Fortunately such cases as these are rare, — not so rare, however, as the number of reported cases would lead one to suppose, for many cases have doubtless been seen which have not been published. Yet whole series of a hundred and even a thousand extractions are reported without the occur-

rence of this accident. De Wecker observed eight in three thousand. A fair idea of their frequency can be got from the following figures. Of thirty-two members of the New England Ophthalmological Society fifteen have seen similar cases, — the same ones in some instances, very likely. Six or seven only have had them in their own practice, private or hospital, and but one as many as three. It is to be regretted that all cases are not reported, for it is only in this way that our present meagre knowledge of these dreadful accidents can be increased, — a knowledge to be used in predicting and avoiding them. The number of post-mortem examinations, too, is discouragingly small, — seven in all; and curiously enough the results do not at all, except in the last case reported by Terson in 1894, corroborate what seems to be the most plausible explanation of this accident, viz., diseased blood-vessels.

In the literature of the subject are several extraordinary cases, which I will briefly mention. Baldwin, of Alabama, operated on a healthy colored woman of sixty-three years, who had an intraocular hemorrhage during extraction so severe that she became dangerously exhausted. The bleeding was checked only by the constant use of iced compresses for eight hours. Panophthalmitis ensued. Kuykendall operated on a black cataract in a woman sixty years of age. T was normal. Sixteen hours after the operation a hemorrhage came on destroying the eye. Four years before, the other eye had been lost, presumably in the same way. Warlomont, in 1883, reported the case of a woman with uncomplicated cataract. The operation was normal and no vitreous was lost. While being led to her bed after the extraction she became nauseated and vomited. The bandage suddenly felt wet and was found stained with blood. The eye was enucleated and examined. The choroid was wholly separated from the sclera, ciliary body and iris were pushed into corneal flap. The retinal and choroidal vessels showed nothing abnormal except that they were gorged with blood. Van Duyse, who examined the eye, argued that "nothing in the histological examination furnished an appreciable contra-indication to an operation by extraction on the second eye."

Warlomont concluded that the mechanical effects of vomiting or jar in walking down-stairs might have had a good deal to do with it, and decided that operation on the second eye with all possible precaution was justifiable. Three months after the first operation Lebrun extracted the cataract in the other eye by his medial corneal incision, this being chosen to avoid any vascular part. No iridectomy was done. The lens was easily delivered, the bandage applied, and the patient moved, without leaving a horizontal position, to the bed at the side of the operating-table. Within a few minutes an intraocular hemorrhage occurred destroying the eye. Another case still more sad, if possible, was reported by Van Duyse in 1891. The patient was a man seventy-one years of age, with hypertrophy of heart, general arteriosclerosis and varicose veins in legs. Health good, no alcohol, no syphilis. Cataract mature both eyes. Perception and projection normal. Tn. The left eye was operated on first. A Wecker incision was made and a small iridectomy; lens and cortical removed without incident and with ease. A preliminary dressing was applied. The other eye was then operated on in a similar way, and equally successfully. The dressing was about to be applied when the wound gaped and vitreous presented in a mass. A part was excised and cold compresses applied, but without avail, as the whole contents of the globe were extended followed by blood. During this time the dressing on the other eye became stained, and on its removal there were found underneath vitreous and blood and retina beside. Blood flowed six hours and oozed for eight days, greatly enfeebling the patient. A case similar to this occurred in Von Jäger's practice.

The cases cited give a good idea of the clinical aspect of these hemorrhages. The time at which the accident takes place varies within wide limits. It is not always during the operation, as in the three cases reported. It is in some instances noticed just before or after the bandage is applied, the blood staining the pad. The surgeon may have given the patient up to the nurse's care, and his attention is called by a sudden cry of pain. In some cases, as we have just seen, it occurs as the patient is being led to the ward,—a

very undesirable proceeding, it seems to me. Still other cases are affected only after hours or days even, being startled by sudden pain and a gush of fluid.

The situation of the hemorrhage in all cases where it has been determined has been retrochoroidal, the blood coming from the choroidal vessels, breaking through and stripping the choroid from the sclera. It is not the intention to include in this paper bleedings from the conjunctival vessels, often so troublesome but not severe, or bleedings from the iris either at the time of iridectomy or later secondary ones, whether they came as the result of jar or not. These varieties are common. Reference is made only to the severe intraocular forms which in the great majority of instances lead to destruction of the eye.

The most important question in connection with this subject is the cause of these disastrous hemorrhages, and for a clearer understanding of this, a few remarks on the tension of the eye are necessary. Intraocular pressure or tension depends on the relation between the capacity of the capsule and the quantity of its contents. Physiologically the capsule changes so little that it can be neglected and considered as constant. Variations in tension normally then are dependent on the alterable contents: viz., aqueous, vitreous, and the blood in the vessels. If aqueous is evacuated the T must be lowered: still more so, obviously, if the lens be removed. If the blood pressure rises or falls, the T must rise or fall unless regulated, and physiologically it is regulated by increased secretion from the blood-vessels and decreased outflow through the lymph channels and *vice versa*. If the blood pressure is raised in the eye in connection, *e.g.*, with general bodily exertion, the T is raised, and contrariwise if the T is lowered by evacuation of aqueous, lens, or part of the vitreous, the blood rushes into the vessels to equalize the T again. There are other complicating conditions, which for our purpose may be disregarded. It is easy now to see that in the extraction of cataract the aqueous being evacuated and the lens removed, there must be a sudden and great lowering of T and the blood must rush to fill the vessels. If these are diseased they may burst and the blood force out

the contents of the eye. Just here, however, there is a great difficulty in that all the examinations of eyes thus far made, with the exception of one by Terson in 1894, have shown sound blood-vessels in both choroid and retina, and this after careful search. This fact has led observers to attribute more or less importance to other causes. I would say in passing that we are not now speaking of eyes which are obviously degenerated, not the eyes of high myopia and its attendant diseased conditions, though the accident has occurred in such with more evident reasons.

It has been urged by some, notably De Wecker, that these hemorrhages occur only in eyes with incipient glaucoma, which is not or cannot be diagnosed, or in subjects of hemorrhagic diathesis. It is well known that iridectomy for glaucoma is very often followed by small hemorrhages into the retina which subsequently clear up. It is even probable that this takes place more frequently than is known, for the fundus is not generally examined in such cases for some time after the operation, if at all. The conditions here are better understood: the vessels are weak, certainly in advanced glaucoma, and the sudden lowering of the tension, relatively greater than in a normal eye, produces the result. It may even happen that a destructive hemorrhage such as we are speaking of may take place, though it is almost unheard of. If, however, we add the removal of the lens, the danger is greatly increased, and several cases of destructive hemorrhages in such eyes are reported. To argue directly from this that similar results mean a similar cause is of course hardly fair. The majority of cases have occurred in eyes which, as far as could be judged, were wholly normal. The tension is a point always carefully looked for, and any increase has been wanting. On the other hand, it is reasonable to suppose that glaucoma has beginnings which cannot be recognized clinically, and in this connection too we must remember that it is thought by many that vascular disturbance brought about by peripheral nerve irritation plays an important part in the production of this disease. So such a theory must be borne in mind in spite of strong evidence against it. It is a remarkable fact that Rheindorf, who has

extracted the lens in glaucoma not stopped by iridectomy or sclerotomy, and also as a substitute for enucleation in certain patients, has in at least forty cases seen no hemorrhage worthy of mention.

As to the hemorrhagic diathesis, there is the great objection that it has not been found. I have seen but one case in which it has been present, that of a woman of fifty-seven, reported by Dagama Pinto. One eye had been lost by post-operative hemorrhage. In a preparatory iridectomy on the other, the excision was followed by very free bleeding into the anterior chamber. In persuading the patient to look down, the back of her hand had been tapped by the surgeon's finger, and for each stroke a subcutaneous bleeding occurred, lifting the skin like a blister. The objection to such a theory for all cases is that the condition has certainly not been present in most of the reported cases, unless we admit its existence in a previously unrecognizable form.

Still another cause, or part cause, is claimed by Van Duyse in the action of the vasomotor system. It is a familiar fact that division of the cervical sympathetic dilates the capillaries of the face. Van Duyse supposes that at a given time a nervous action, arising perhaps from the corneal section, goes to the brain and is reflected back to a point where hemorrhage is to take place, — a point of feeble resistance. Beside this there is the emotional shock which overturns the normal circulation. Reference may again be made to the supposed influence of peripheral irritation on the vascular state, spoken of before, in connection with the production of glaucoma. Such a theory as this best explains, he thinks, why the hemorrhage may come on some time after the operation, owing to the emotional condition and the irritation still existing about the wound. From experiments on rabbits, Van Duyse concluded that sound ocular vessels needed more than moderate pressure to burst them. He therefore put aside the idea of healthy vessels, even in the face of the negative evidence so far produced. This was before the publication of Terson's case. The weakness shows itself, he says, because of the lens extraction, this

cause acting alone or in conjunction with other causes: viz., causes engendering or augmenting the intraocular congestion, — venous stasis, mechanical or emotional congestion, and reflexes.

The best conclusion then seems to be that there must be some weakness of the vessels, and that the break comes from increased congestion incident to the suddenly lowered tension. This view must be held to in spite of strong contradictory evidence in the post mortems and in spite of the fact that the operation for cataract, even in people with quite imperfect vascular systems, is almost universally successful. As Terson says, histologically sound vessels are not necessarily physiologically sound ones. It is a wonder that the accident does not occur oftener. Reference has already been made to the frequency of retinal hemorrhages after iridectomy for glaucoma. I think it is a question, too, if a similar thing does not occur in cataract extraction at times. I have in mind an old man operated on by me at the Infirmary, whose vision was unaccountably low. A careful examination revealed a small macular hemorrhage which in the course of a few weeks, without others appearing, cleared up, leaving a vision of 0.7–0.8. We must bear in mind that cataract is generally regarded as the result of faulty nutrition, in which the vessels must play a large part, and that the vascular system of these patients — we are speaking of the senile cataract — is often an imperfect one.

Inasmuch, however, as the accident is so very rare, even with these conditions, it is well that other possible causes can be added to this main one. Glaucoma certainly can and does play a part in recognizable cases, the influence of the vaso-motor system would seem more uncertain, though it perhaps more easily than anything else explains the late occurrence of the accident. Terson thinks it easy to imagine that the influence of some sudden emotion on an hypertrophied heart can determine at some later time the break in a weakened vessel. I have omitted to speak previously of trauma and loss of vitreous. Hemorrhage from blows can hardly be included in the subject: but whatever makes unusual manipulation of the eye necessary during extraction, of

course favors bleeding in an eye predisposed to it. To me a satisfactory explanation of the delayed hemorrhage is that some jar or strain suddenly determines the bursting of a poor vessel, much weakened at the time of operation, and still further weakened by the force of the current constantly acting on it. Loss of vitreous, by adding to the suddenly lowered tension, and whatever tends to cause this loss, are still other factors.

From what has already been said it will be seen that in most instances it is impossible to predict that this accident will take place. Having, however, had the unpleasant experience in one eye, what is the prognosis for the other? In the first place, it is a maxim agreed by all now, I think, that both eyes should never be operated on at the same time. Warlomont's final conclusion from his case was that there were certain eyes, wholly sound as far as could be determined, and with healthy vessels, in which hemorrhage would occur after cataract extraction. He advised never to operate on the two eyes at the same time, and on the second only by needle. (I have recently seen the microscopic specimen of an eye lost by intraocular hemorrhage after needling.) A celebrated French oculist once said that if such an accident ever happened to him he would do a couching operation on the other eye. Abadie proposed continuous compression of the carotid for twenty-four hours, previous injections of ergotine, and the use of other operative measures. De Wecker advocated a preliminary iridectomy; but even this may bring on the same consequences, and a few cases have been reported where it has been done as a precautionary measure without avail (Mooren, Bribosia, Fienzal). The most recent suggestions by Terson are the giving of cardiac sedatives before the operation, and the avoidance of all possible emotional disturbances. The question what to do when confronted by this grave condition seems to me to depend wholly on the condition of the eye. If all the vitreous has been extruded with perhaps the retina, time and suffering will be saved by immediate enucleation. If, however, the hemorrhage does not make its appearance, — which happened in our own case, but is not usual, — it is

justifiable to wait: some eyes, though not the sight, can possibly be saved.

I regret that the cases here reported throw so little light upon the subject. Dr. Wadsworth's second case was certainly a doubtful one. His first was apparently a perfectly normal eye, the only suspicious circumstance relating to it being the sudden death by apoplexy of the patient within a year. My own case is not free from doubt, the projection having been apparently a little faulty. Perhaps too little was thought of this at the time: but the operation did not, and could not, make his vision worse, and was surely justifiable.

X.

THE OCCURRENCE AND PREVENTION OF FLAT-FOOT AMONG CITY HOSPITAL NURSES.

By R. W. Lovett, M.D.

The following is an account of some work done among the nurses of the Boston City Hospital, with the aim of providing them, if possible, with a suitable boot, and diminishing the amount of foot trouble among them.

It is well known that trained nurses, especially during their hospital duties, are very liable to suffer pain and discomfort in the feet, sometimes to a serious extent. This disability, as a rule, has been attributed to a breaking down of the arch of the foot, and has been spoken of as "flat-foot." At the Boston City Hospital, trouble with the feet among nurses has been common, and although previous to 1892 no record had been kept of the loss of time caused by it, it is stated that it was more common than since a record has been kept. The aggregate loss of time from foot trouble among the nurses amounted, in 1892, to 42 days, in 1893 to 125 days, and in 1894 to 41 days. Regulation shoes of three different kinds had been tried, and each in turn proved unsatisfactory.

In April, 1895, the writer was requested by the superintendent to supervise the footwear among the nurses, and on the first of May the work was begun. In addition to the adoption of a sensible boot, it was undertaken to prescribe for each nurse individually. This prescription was taken to a shoe-store where boots were furnished according to directions. The boots were then inspected before being worn. Probationers were seen when they came to the hospital, and also other nurses whose boots were worn out, or who were having trouble with their feet, or who wished for any reason to order new boots. The case of each nurse was recorded as follows:

(1.) The history was taken as to previous trouble in the feet, especially in connection with severe illness or injury.

(2.) An outline tracing of the foot, bearing weight, was taken by a pencil held perpendicularly to the paper, and superimposed on this was taken a tracing of the outline of the boot worn at the time of the examination. The latter showed the relation in size of the sole of the foot to the sole of the boot.

(3.) Lastly, with the bare foot, the nurse stepped on a piece of smoked cardboard, leaving a white imprint of the sole.

Flat-foot, so called, has been studied largely through

1. Imprint of normal foot. 2. Imprint of contracted foot. 3. Imprint of flat-foot.

some form of imprint tracing of the bare feet. Early in the present inquiry, however, it became evident that the print of the sole of the foot gave little trustworthy evidence as to the condition of the foot, so far as its usefulness was concerned. This was quite in accord with the previous views of the writer, and was especially made evident in a series of tracings taken as a preliminary step at the office of the Civil Service Commission, through the kindness of Dr. Morton Prince, where the tracings were of healthy young men, applicants for the positions of policeman or fireman. The type of tracing spoken of as normal is shown. It presented different variations which seemed to be of no practical value, and the writer was unable to attribute any importance to the presence or absence of the transverse

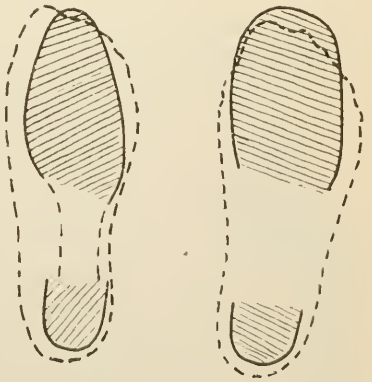
arch. A typical normal tracing was presented in the cases of several nurses who suffered discomfort, and notably in the case of one nurse who came very near breaking down when she first entered the hospital.

One nurse in ten showed in one or both feet a type of tracing supposed formerly to be pathological, and described by Dr. Shaffer as "non-deforming club-foot." In these tracings the heel and ball of the foot alone touch the ground. This condition gave no discomfort in any case, and was associated with a useful foot. The writer prefers to speak of this condition as contracted foot. Its pathology and etiology are almost unknown.

The same proportion of nurses — one in ten — showed in one or both feet a tracing of the type characteristic of flat-foot, yet these nurses had no distress, and did not suffer from pain or disability.

The conclusion from this is that the smoked tracing is of little value in the study of the arch of the foot.

The tracing of the outline of the foot, as compared with the outline of the sole of the boot, showed that in nearly all cases the boot being worn was too narrow across the metatarso-phalangeal joint, that the forward inner edge of the sole was cut away, which in every instance would cramp the forward part of the foot, displacing the great toe outward. The disproportion between the size of the foot and the size of the boot was so great that it was surprising that more cases of disability were not present. Two average cases are shown, one demonstrating the uselessness of a broad toe to the boot without other good points.

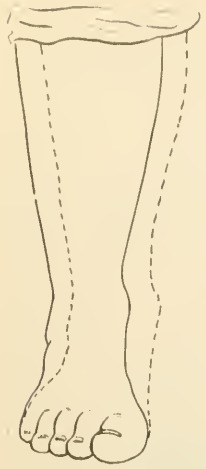


4. Outline tracing of the boot and of the foot. The foot is in outline, the boot is shaded.

5. The same as 4.

It became evident early in the inquiry that there was an

element of trouble present not to be detected by either of these lines of investigation. This element seemed to be a pronation of the foot, or more simply a "rolling-in" of the ankle. This was seen in looking at the feet which gave trouble, as an increased prominence of the inner side of the ankle and an abduction of the forward part of the foot. The line of the leg, instead of passing as it should through the second metatarsal, sometimes fell inside of the great toe, and the foot in its relation to the leg was changed and appeared decidedly rolled outward. This condition of *pronation of the foot is anatomically and necessarily associated with abduction of the forward part of the foot.* Thus these two appeared as an associated group of symptoms in nearly all of those cases which were troublesome or weak. The figure shows a photograph made by a double exposure on the same plate of a foot held in the correct position, and then allowed to fall into the pronated position. *Pronation and abduction of the forward part of the foot are associated as a compound movement and cannot be disassociated.* Any one may demonstrate this for himself by first holding his bare foot in the normal position so that the line of the leg brought downward passes through the second metatarsal, and then allowing the muscles



6. Normal and pronated portion of the foot. The latter in dotted outline.

7. Normal position of the foot.

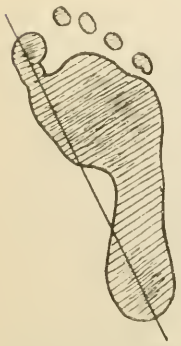
8. Pronated and abducted position of a pronated foot; no change in the normal tracing.

which retain this position to relax, when the ankle will roll in and the forward part of the foot will be abducted.

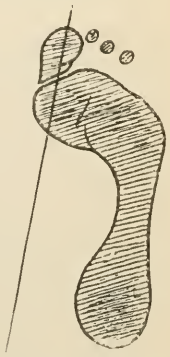
The position of abduction of the foot is the position of muscular effort in which the arch is held up by the flexor muscles, the position of *strength*. The position of abduction associated with pronation is the position of muscular *weakness*, and ligamentous instead of muscular support. The condition of abduction and pronation will be described as "pronated foot." In many instances it is the early stage of flat-foot, but not necessarily so.

9. Ordinary flat-foot, with breaking down of the arch, as shown by imprint tracing.

Some degree of pronated foot was found in the great majority of all the nurses examined. Cases where this was marked were the cases which had suffered pain and discomfort. These patients wore out the inner part of their boots, treading them over on the inside, their feet tired easily, and pronation seemed to be the only element proportionate to the amount of discomfort suffered. This element of pronation has seemed to the writer the important factor in estimating the usefulness of a foot.



10. Meyer's line in the normal foot.



11. Average course of Meyer's line among the nurses.

For the selection of a boot certain requirements are obvious and need no discussion.

(1.) The inside of the boot should be straight or nearly straight. Meyer's line is characteristic of the normal foot, and is the prolongation backward of the axis of the great toe. In the normal foot this line should pass through the central

part of the heel. In no case among the nurses was this condition fulfilled. In most cases Meyer's line passed entirely clear of the imprint of the heel.

(2.) There should be room across the front of the boot opposite the metatarso-phalangeal joint for the forward ends of the metatarsals to rest on the ground without being crowded together or overlapping each other.

(3.) The shank should be moderately high and should not be cut away on the inner side, in order to afford as much support to the arch as possible.

(4.) What is to the writer's mind one of the most important elements is that the boot should be made to hold the foot in an adducte position. It should be built on a curved with the convexity outward. That is, the forward part should form an angle with the heel. This holds the foot in the position in which the muscles find it easiest to work, and associated as adduction is with pronation, to prevent the one is to a certain extent the prevention of the other. The position of abduction assumed by weak and tired feet is not rendered easy in boots which are built on such a curved line, and the concavity of the inner side of the foot is important in preventing the breaking down of the arch. These are no new principles in boot construction, but on these general lines the boot used among the nurses was constructed.

From May 1, 1895, to Dec. 11, 1895, eighty-five nurses were seen, and on December 12 sixty-two nurses were wearing boots such as have been described above, the remainder having graduated from the school meantime. Individual variations were made to accommodate such peculiarities as bunion, high arch, etc., but in general this type of boot was strictly followed. In the report of a boot inspection made by the Superintendent of Nurses dated Dec. 10, 1895, it was reported that only one nurse was dissatisfied with the boots and refused to wear them. The others reported favorably for the boot.

Up to December 11 there was no loss of time from foot trouble for the year 1895. On that day a nurse had to give up work with what appeared to be trouble with the arch of the foot, but which developed later into something more like

general rheumatism. In addition to these figures, which might of course be misleading, it is the opinion of the superintendent and matrons that there has been decidedly less foot trouble among the nurses since the adoption of the boot.

These nurses represent a set of healthy young women from whom all noticeably feeble ones have been excluded by an examination before entrance, yet forty per cent. gave evidence of some trouble in the feet, before being seen by the writer. This proportion in the community at large would probably be greater among women of all classes. This is not surprising if one studies the sort of footwear in general use. The shoes worn by children with both sides alike tend to push the great toe out of the line where it belongs, to hamper the muscles, and to favor pronation, and thus to begin the mischief, and the pointed toe of later years serves still further to displace the great toe outward. This displacement removes part of the support of the foot on its inner side, and also impairs a muscle which is most important to the support of the arch, the flexor longus hallucis. For these two reasons this outward crowding of the great toe favors pronation of the foot. Narrow boots with flexible shanks which are cut away at their inner borders not only fail to support the arch as they should, but they impede the function of the muscles and make it impossible for the wearer to stand properly on the bottom of the foot.

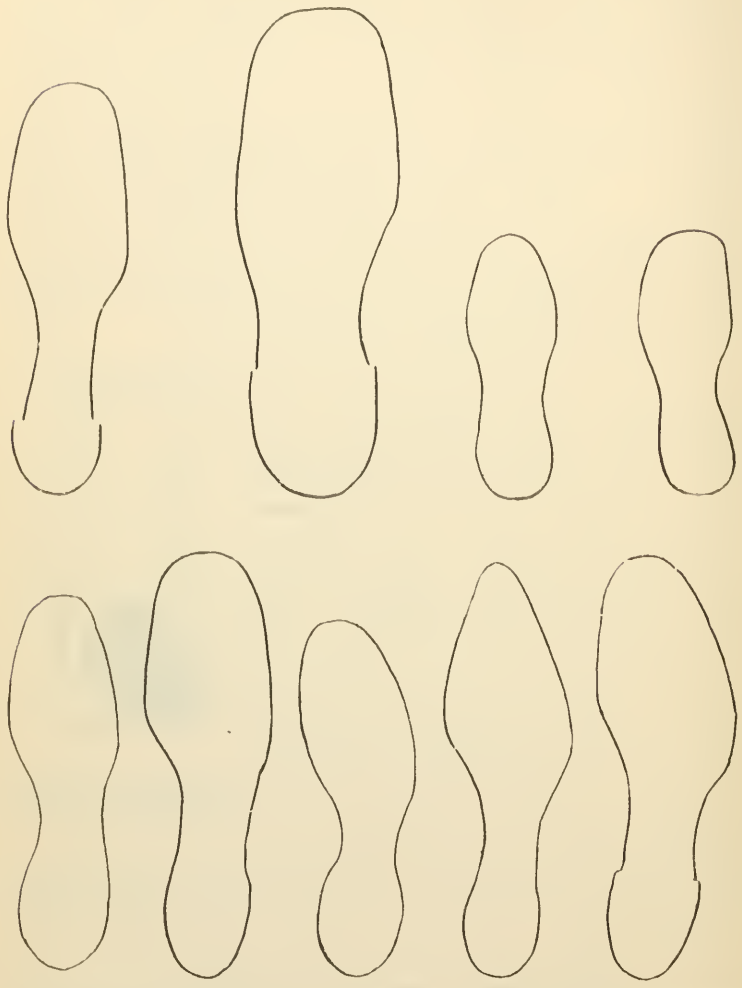
12. Slightly pronated foot. On the dorsum of the foot is shown the size of the sole of the boot.

The tracings of various boots are shown.

The one conclusion which the writer would wish to present from the work done is that "pronation" of the foot is the disabling element apparently, and one which should be studied rather than imprint tracings. Much success has followed the experiment of making the inner side of the heel and sole one-eighth to one-fourth of an inch thicker than the outer side in nurses with pronated feet.

So far as one may draw conclusions from the work which has been done, it may be said:

That the inferences drawn from smoked tracings are



not always reliable, and that variations from the normal are not necessarily indicative of a painful condition.

That pronation of the foot is the important factor which is almost always present in disabling conditions, and that it must be studied where we find it with a view to its actual measurement.

That the relation of the sole of the foot to the sole of the boot would seem to indicate a cause for widespread discomfort and damage in the compression to which feet are subjected.

That a rational boot can be worn with comfort if individual peculiarities are studied.

That the essentials of such a boot are:

(1.) A straight or nearly straight inside edge.

(2.) The adduction of the forward part of the foot.

(3.) Sufficient width opposite the metatarso-phalangeal joint.

(4.) A stiff broad shank rather higher than customary and not cut away at its inner aspect.

XI.

NOTES ON APPENDICITIS AT BOSTON CITY HOSPITAL.

By J. Bapst Blake, M.D.

The result of an examination of the City Hospital records in regard to inflammatory processes of or about the vermiform appendix from 1880 to July 1, 1895, is as follows: 402 cases, 62 deaths, 15.4 per cent. mortality.

These cases are divided:

Typhlitis,	7 cases with	2 deaths.
Perityphlitis,	61 cases with	5 deaths.
Appendicitis,	334 cases with	55 deaths.
	402	62

Two of the 7 unoperated cases of typhlitis were fatal.

One of the 51 unoperated cases of perityphlitis was fatal.

Ten cases of perityphlitis were operated with 4 deaths.

The total mortality of all operative cases in the hospital to July 1, 1895, is 26.6 per cent.

The mortality of all unoperative cases to the same date is 8 per cent.

The records illustrate graphically the development of our knowledge of the essential etiology of these processes. The earliest mention which the writer has found of a localized inflammatory process about the appendix was in the year 1882, under the head "Perityphlitis." In 1885 the diagnosis "Typhlitis" appears, and not until 1886 and 1887 is "Appendicitis" mentioned, the first case being on the medical side. In 1886, 1887, and 1888 a single case was treated in the hospital each year; in 1889 were 7 cases; in 1890, 7 cases; in 1891, 31 cases; and in the year ending July 1, 1895, there were 113 cases of appendicitis, none of perityphlitis, and only one of typhlitis, and this in a patient from whom the appendix had previously been removed, and

who returned to the hospital for a few days on account of slight pain and tenderness in the right iliac region.

Excluding from consideration cases of so-called typhlitis and perityphlitis, there remain 334 cases which are entered on the records as *appendicitis*. Of these, 37 were treated on the medical and 297 on the surgical side.

Medical { operative, 1, no death.
non-operative, 36, 8 deaths, 22.2 per cent.

Surgical { operative, 143, 38 deaths, 26.5 per cent.
non-operative, 154, 9 deaths, 5.8 per cent.

The relative death-rate of the non-operative cases on the medical and surgical side is striking.

The forty-seven fatal cases have been examined in detail. Thirty-eight were operative, nine non-operative. Only two of these cases were admitted as early as the third day of the disease. Both of these were very severe from the beginning. About 25 per cent. were admitted on the fourth day after the first symptom, and the remainder came to the hospital at periods varying from five to twenty days after the onset of pain and fever. In the majority of cases, therefore, an early operation was impossible, even if advisable.

DATE OF DEATH AFTER OPERATION. — 38 CASES.

On day of operation	9
1st day after operation	6
2d " " "	8
3d " " "	1
4th " " "	2
5th " " "	5
6th, 7th, 8th, and 16th day after operation,	1 apiece
12th day after operation	2
14 weeks	*1 case*

Sixty per cent. of all operative fatal cases died within two days after operation, and 81.5 per cent. within three days.

Apparent cause of death, and autopsies:

In the majority of cases no autopsy was permitted.

Nine cases died on the day of operation; none of these rallied fully from the ether.

Fourteen died within two days, with all the signs of purulent peritonitis, usually with mild delirium.

An autopsy on one of the two cases which died on the fourth day revealed a pus cavity not discovered at the operation. The other case died of purulent peritonitis.

The third and one of the fifth day cases died of unexpected sudden collapse, the former with symptoms of intestinal perforation, the latter of pulmonary embolism.

The four remaining cases which died on the fifth day had purulent peritonitis, to which one added a broncho-pneumonia, and a patent opening in the appendix, found at autopsy.

The case which died on the seventh day had a fæcal fistula, and at autopsy were found three pus cavities, and an intussusception of the small intestine into the cæcum.

The sixteenth-day case was found at autopsy to have a general streptococcus infection, with abscesses of the liver and a walled-off pus cavity.

The two twelfth-day cases developed symptoms of retained pus; in both the wound was reopened, pus evacuated in one, no pus found in the other.

The patient who died in fourteen weeks was one in which the wound was closed, but afterward broke down, a fæcal fistula developed, and he died of marasmus.

The latter was the only case in which gauze or rubber tube drainage was not used. The earlier cases, as a rule, were treated by rubber drainage tube, the later cases by gauze, usually iodoform wicks.

Record of urinary analysis was found in 26 cases; 19 contained casts or albumen, or both: only 3 were free from casts.

The other 7 urines were high-colored and concentrated.

It is most unfortunate that the number of autopsies is so small, 8 only in 47 cases. The absence of a post-mortem deprives most of the cases of that element, which is not only most instructive in itself, but which enables us to weigh more accurately the value of the earlier symptoms, and to

study more carefully the indications which the treatment did not reach. In spite, however, of this serious defect in the histories, certain deductions may be made. The controlling factor in a large majority of these fatal cases, looked at from a surgical standpoint, seems to have been either the shock of the operation, or insufficient drainage. The first factor would seem to indicate earlier operations; the second has two parts, — one, perhaps, more extensive and numerous incisions and more thorough irrigation and drainage, the other a more persistent search for pus pockets and perforated appendices. The first of these indications is controlled by the time at which the surgeon first sees the case: the second depends on the condition of the patient and on the judgment of the operator. The fact that a majority of these fatal cases began with a severe or agonizing pain is suggestive.

The character of the urine should always be considered, not alone in reference to the propriety of operating, but especially in relation to the prognosis.

The two cases of sudden and unexpected fatal collapse in patients apparently progressing satisfactorily suggest the necessity of a guarded prognosis.

It would seem that the point upon which we have yet perhaps most to learn is the extent to which adhesions should be broken up in the search for pus or for an undiscovered appendix, and the relative danger of taking the chance of infecting the general peritoneal cavity, or of leaving undrained a small pus cavity.

One deduction is most obvious: it is that appendicitis is essentially surgical from the beginning: that in a considerable percentage of cases the operation is performed too late to give the patient the chance of benefiting by it: and that it is the patient's right to be placed under conditions which admit of immediate operation from the moment the diagnosis is made.

XII.

RECENT ADVANCES IN THE METHODS OF LOCAL ANESTHESIA.

By F. B. Lund, M.D.

It cannot be denied that there are certain disadvantages, which may at times assume serious proportions, connected with the administration of a general anesthetic for certain operations.

The disadvantages of anesthesia by ether and chloroform, the best anesthetic agents we possess, are in large measure inseparably connected with the fact that they act directly upon the centres of thought, sensation, and muscular action. The after-effects — nausea, dizziness, vomiting, etc. — are, as in alcoholic intoxication, the results of the toxic action of the anesthetic upon the central nervous system, reflected to the peripheral organs. It seems in the nature of things improbable that a general anesthetic will be found which will be free from the after-effects due to intoxication of the central nervous system. With the fact that there is a certain amount of danger connected with the action of a general anesthetic, it is always the duty of a surgeon to acquaint his patient. While in many, I may say in most, cases, this danger is so slight that it may be almost disregarded, there are others — such as those of shock from strangulation of the bowel, respiratory embarrassment from collections of pus in the chest, asthenia from prolonged malnutrition, chronic bronchitis and myocarditis complicating abdominal affections demanding operative treatment, etc. — in which the anesthetic most seriously complicates an operation.

The employment of general anesthesia in operations of short duration, as in minor surgery and in out-patient prac-

tice, has the disadvantage of requiring an extra assistant, and if, as is sometimes the case, the operation has to be prolonged beyond the period of primary anesthesia, of subjecting the patient to the disagreeable nausea, vomiting, etc., following the ether, and necessitating either a stay overnight at the hospital or sending an attendant home with the patient. Considerations such as these have led to the adoption of a rule in many hospitals that no patients shall be etherized in the out-patient department unless they have some one with them to see them safely home. As a result of such rules, many patients have been subjected to the severe pain of operation without an anesthetic, or the already overtaxed wards of the hospital have been further crowded with patients who might perfectly well have been operated on and sent home if they had had some one with them, or if a general anesthetic had not been required.

The desirability of a local anesthetic which should be free from danger — some substance which, without intoxicating the central nervous system, should temporarily paralyze the sensory nerves supplying the operative field — has led to active endeavor on the part of surgeons to discover some such agent. Up to the year 1884, when Köller, a student of medicine at Vienna, accidentally discovered the anesthetic effect of the drug cocaine upon the mucous membrane of the eye, the only methods of local anesthesia of wide practical application depended upon the numbing effect of cold upon the nerves, and consisted in freezing the part to be operated upon either by the application of freezing mixtures or by spraying with some rapidly evaporating ethereal compound. This method possessed the disadvantages that the process of freezing and thawing is in itself attended by no slight degree of pain, and that it could be safely applied only on regions of most limited area, and sufficed only for the most rapid operations.

The anesthesia produced by cocaine applied to the mucous membranes was found to be attended with no such disadvantages: and, although the drug was poisonous, it was found that sufficient local anesthesia could be produced without its absorption in poisonous amounts.

Attempts were at once made to produce local anesthesia of the skin and subcutaneous tissues by the external application of solutions of cocaine, but it was found that sufficient absorption did not take place to produce anesthesia. The introduction of cocaine solutions by electrolysis was tried without success. To an American physician, Dr. Leonard J. Corning, of New York, is due the credit of demonstrating the fact that solutions of cocaine injected subcutaneously along the trunk of a sensory nerve would produce local anesthesia in the area of its distribution. It was found difficult, however, to found a satisfactory technique upon this principle. As applied, it consisted of the injection of a few minims of a two to five per cent. solution of cocaine under the skin in four or five places surrounding the operative field, and so situated as to reach, if possible, the branches of the sensory nerves which supplied it. It was found necessary to wait five or ten minutes for the drug to be diffused among the tissues, and so to be brought in contact with the various nerve filaments which supplied the part. Operations performed after this method were often entirely successful, but often for some unknown reason the anesthetic effect failed, to the great chagrin of the surgeon. This failure was due to the well-known fact of the abundant anastomosis of terminal nerve filaments. Although one or more of the nerve trunks supplying the area might be anesthetized, it often happened that one running deeper through the tissues or coming from a different direction, furnished, through its terminal anastomosis, a path for the conduction of pain.

Dr. Corning also demonstrated the fact that in suitable cases the application of an elastic ligature, by imprisoning the anesthetic fluid in the part, deepened and prolonged the anesthesia.

Sometimes, however, even where this precaution was adopted, the result was unsatisfactory, — a fact which was probably due to the circumstance that some nerve trunk sent anastomosing filaments which were not reached by the anesthetic fluid, and served to conduct the sensation of pain.

Another reason for failure was the mistake sometimes

made by the surgeon of making the first needle puncture directly into the inflamed tissue, a procedure almost as brutal as the performance of the operation without the anesthetic. A large number of surgeons having been for some such reason unsuccessful in their first trials with local anesthesia by cocaine, gave the matter up without further study or trial, and either employed general anesthesia for all minor operations or operated without any anesthetic. Certain men, however, notably Reclus in France, Landerer in Germany, and Halsted in this country, persisted in its employment, and developed the technique. In this city, Dr. S. J. Mixter was one of the first to demonstrate in practice the advantages of local anesthesia by solutions of cocaine.

The solutions which it was first thought necessary to employ were, however, so strong (two to five per cent.), as to render injection of the drug over large areas a procedure not unattended with danger, and to limit its employment to slight and short operations. Gradually, however, weaker solutions came to be employed, and of these it was found possible in many cases to use enough to infiltrate the whole operative field with the solution. When this was done, that is, when the cocaine solution was injected into the skin, not under the skin, and when, starting from the area infiltrated by the first puncture, the operative field was gradually and thoroughly drenched with the fluid, the needle never being pushed outside of the area previously anesthetized, a perfect local anesthesia to all operative procedures was found to be produced. Weaker solutions (two per cent. and less) were found to give the best results, because it was safe to use enough of them to thoroughly infiltrate the tissues. When this was done it was found not to be necessary to wait for the anesthetic effect to be produced, but that the operation could be begun at once. Those who had the most knowledge and skill in the use of cocaine used the weaker solutions (one-half to one per cent.), but the strength most generally employed in this country and abroad was two to five per cent.: a strength which it would not be considered safe to employ except in small amounts, and which limited application of the method to very slight opera-

tions, and prevented its successful use in more extended operations in cases where, owing to the condition of the patient, a general anesthetic was undesirable.

The occasional reports of fatalities from poisoning by cocaine employed as a local anesthetic stigmatized the method in the minds of those not familiar with its use, although several surgeons, both in this country and abroad, had had no fatalities, and had found the appearance of premonitory symptoms of poisoning an exceedingly rare event.

Those who had most experience in the method realized its limits, and after the amount of cocaine had been injected which it was thought safe to employ, and the operative field had to be further extended, either had recourse to ether, or continued the operation without anesthesia, both of which expedients were of the nature of confessions of defeat. In certain instances it was found that after anesthesia had been established by cocaine solutions, the anesthetic area could be extended by injecting pure water, beginning within the infiltrated area. The injection of water without previous cocainization is, however, as the writer can testify from personal experience, an exceedingly painful process.

Such was the condition of our knowledge of the action of cocaine when Schleich, of Berlin, published a monograph which, if true, placed local anesthesia by the injection of anesthetic fluids upon a scientific basis, and rendered its more extended application safe and feasible. This method has since been given extended trial; and while it has not and probably will not, as its author thinks probable, become of such general application as to render the employment of a general anesthetic a surgical rarity, it has none the less widened in some degree the field for the safe and efficient use of local anesthesia, and enabled operations to be performed without pain or danger, in cases where a general anesthetic was contra-indicated. To Schleich is due the credit of demonstrating that the intracutaneous injection of various drugs (not alone cocaine) in very dilute solution produced local anesthesia. Instead of the effect depending solely upon the drug itself, the anesthesia was found to be due to the pressure of the infiltrating fluid upon the nerve

filaments, the artificial anemia which it produced, and the comparatively low temperature at which it was injected.

These facts, which are significant in that they enable us to dispense with the cocaine except in proportions too small to cause any apprehension of danger, were gradually arrived at by Schleich in the course of careful experimentation upon himself, his assistants, and nurses. Beginning by gradually diminishing the strength of the cocaine solutions employed, and following the principle of endermatic injection, he found that in the white wheal produced by the injection of a syringeful of a two-hundredths-per-cent. solution of cocaine there was absolute insensibility to pain, and also that no pain was present during the injection. This solution was so weak as to suggest that the cocaine might be entirely omitted, which was done, with the result of finding that complete anesthesia was produced throughout the area of infiltration, but that severe pain was experienced during the formation of the wheal. This is a beautiful example of the anesthesia dolorosa, demonstrated by Leibreich in experiments upon animals, an anesthesia which follows only upon a rather severe irritation of terminal nerve filaments by the injection of irritating fluids, resulting in their temporary loss of function. This process, although it finally results in anesthesia, is so painful as to be practically inapplicable.

It was next found that physiological salt-solution (six-tenths per cent.) produced no pain on injection, but that it also had no anesthetic effect, a fact probably due to the circumstance that it was absolutely non-irritating to the nerve terminals. A salt-solution of two-tenths per cent., however, was found to produce only slight paresthesia on injection, while complete anesthesia was found present in the infiltrated area. With this solution a nevus was excised from the neck of Dr. von Bergmann without producing the slightest pain.

Solutions of other drugs were also found to have the same anesthetic effect, notably these: Sugar, three per cent.; potassium bromide, three per cent.: morphine, one per cent.: carbolic acid, five per cent.; and caffeine, two per cent. The anesthesia was found, however, to be preceded by more or less irritation.

Inasmuch as common salt-solution is an efficient anesthetic in the strength of two-tenths per cent., it may be asked, Why is not that sufficient, and why should any cocaine or morphia be added to the fluids to be practically employed for local anesthesia? The answer is, that although the injection of two-per-cent. salt-solution into healthy tissues produces but slight pain, the surgeon has often to deal with tissues rendered hypersensitive by inflammation. The injection of salt-solution into inflamed tissue causes extreme irritation and pain. The gratifying fact, however, was ascertained by Schleich that by the addition of a very small amount of cocaine, morphia, or carbolic acid to these solutions they could be successfully employed even in tissue rendered hyperesthetic by the pressure and tension of inflammation. Although these cases where the tissues are swollen and brawny are the most difficult which are presented to the surgeon, it was found that with care and skill in making the injections anesthesia could be produced by the employment of a solution containing twice as much cocaine as that employed for normal tissue, though still so little ($\frac{1}{500}$) that twenty-five syringefuls of twenty minims each could be safely employed.

For successful anesthesia in these cases a careful technique is essential. Owing to the fact that the anesthetic effects of the infiltrating fluids are greatest when they are injected at a low temperature, it is advisable, although not absolutely essential, to keep the bottle on ice before the operation. By beginning the injection endermatically, not hypodermatically, in the healthy skin surrounding the inflamed area, and advancing carefully upon the latter, it is to be gradually and thoroughly infiltrated. The area of infiltration must be extended not only around but beneath the inflamed tissue, so as to surround it with an area of artificial edema, and if this has been successfully accomplished we are able to cut, curette, or perform any necessary manipulations absolutely without pain. In infiltrating the wall of an abscess, it must be remembered that injections into the cavity itself do no good. If there is no outlet they cause extreme pain from increased tension; if an outlet is present they run out

without infiltrating the tissues, and therefore without producing any anesthetic effect. Injections into the sacs of cysts or the tissues of tumors which we wish to remove are equally fruitless in their results.

It is also absolutely essential to remember that only the infiltrated, edematous tissue is anesthetic, and that when it becomes necessary to extend the operative field beyond the infiltrated area the injections must be carefully continued out in the direction required, starting within the anesthetic area. It will not do to take it for granted that the patient will bear the pain of a single cut outside of the anesthetic area, for in so doing we forfeit our claim to the production of anesthesia, and will not have an opportunity of trying the infiltration anesthesia again upon that patient or his friends. The anesthesia begins immediately after the infiltration is completed, and lasts about twenty minutes. Every tissue of the body, nerve, muscle, skin, gland, mucous membrane, etc., is rendered anesthetic when infiltrated in the manner described, and the same effect is produced upon bone by infiltrating the periosteum, or injecting the medulla.

Nerve trunks are anesthetized in the same manner as mucous membrane, by first touching a spot with a drop of pure carbolic acid, and through this making the injection.

Owing to the distention of the tissues produced by the injections, and to the resulting compression of the smaller blood-vessels, comparatively little bleeding takes place from incisions made in the infiltrated tissues. When it is necessary to seize a divided artery with hemostatic forceps, Schleich advises that it be touched with a pledget of cotton dipped in pure carbolic acid, in order to anesthetize the nerve which is apt to accompany a small arterial branch.

This precaution has been so far found unnecessary by the writer.

FORMULÆ.

The following solutions are recommended by Schleich, the first or stronger one being necessary only for operating on inflamed or hyperesthetic tissues. The second is used

for all operations of no more than moderate extent on tissues not inflamed. The third is to be used in extensive operations when it has been necessary to inject so large an amount of the other solutions that there is danger of exceeding the limit of tolerance of the drug.

No. 1.

Cocain. mur.	.2
Morph. mur.	.025
Natr. chlor.	.2
Aq. dist. sterilisat. ad	100.
Adde acid. carbol. (5%)	2 gtt.½

M. D. S.

No. 2.

Same as No. 1, except cocaine	.1

No. 3.

Cocain. mur.	.01
Morph. mur.	.005
Natr. chlor.	.2
Aq. dist. sterilisat. ad	100.
Adde acid. carbol. (5%)	2 gtt.

M. D. S.

The small amount of morphia present in these solutions has been added for the purpose of diminishing the pain which sometimes follows operations under infiltration anesthesia during the time the infiltrating fluid is being absorbed, and the carbolic acid to ensure the preservation of the solution.

By the use of these solutions, Schleich claims to have performed such operations as ovariotomy, cholecystotomy, ligature of the common carotid, and, in fact, to have been able almost entirely to dispense with general anesthesia.

During the last two years, more or less trial of the method has been made in this country, and last spring a paper was read before the American Association of Genito-Urinary Surgeons, by Dr. Bransford Lewis, in which he expressed the greatest satisfaction with the method in slight and superficial operations, but said that he had met with comparatively poor success in infiltrating the deeper tissues in operations of any extent. He was inclined to think, however, that his

lack of success was in large degree due to lack of practical experience in the method, and that with improvement in his own operative technique the limits of the method in his hands would be extended.

In fact, the general verdict has been, where the method has been honestly and carefully put in practice, that with experience many errors in the technique of application could be avoided, and the usefulness of the method considerably extended.

Since Dr. Post called my attention to the method, as described in Dr. Bransford Lewis's paper last June, I have had the opportunity of practising the method in a large number of cases of minor surgery in the Out-patient Department at the Boston City Hospital.

On comparing the results attained with Schleich's solutions with those of a considerable previous experience in the use of one and two per cent. solutions of cocaine, I find that Schleich's weaker solutions are more satisfactory, for the reason, probably, that as the surgeon is freed from anxiety lest a poisonous dose of cocaine should be employed, sufficient solution is generally injected to thoroughly infiltrate the tissues, so that all the nerves supplying the part are anesthetized. The operations have usually resulted in little or no pain. Certain failures have been recorded. These can sometimes be ascribed to faulty technique, or to the application of the method in unsuitable cases.

The method is not suitable, in my belief, to extensive operations in inflamed and brawny tissues, owing in large degree to the mechanical difficulty of thoroughly and painlessly infiltrating all the inflamed area. Especially is this true when the inflamed tissues are tough, calloused, and richly interwoven with fascial fibres, such as abcesses in the palm of the hand and sole of the foot in laboring men. In these cases, I have found primary anesthesia to give the best results. On the other hand, a soft, pliable palm has often been infiltrated with perfect success.

Where the tissues are loose and spongy, even if considerable inflammation is present, the method is very successful. Felons of the fingers are opened and curetted.

sequestra removed, amputations and all necessary manipulations performed, often absolutely without pain. The skin, connective tissue, and periosteum of the part must first be infiltrated, beginning in the healthy tissue above the zone of inflammation. The saving of the time formerly required for etherization of these cases has been a marked benefit in the hurry of out-patient work; one less assistant, at least, is required, and the patients can walk home without waiting for the nausea and dizziness of ether to pass off.

In the performance of more extensive operations by this method, it has been found that the chief requisite for success is slow, careful, thorough infiltration of the tissues, the most scrupulous care being taken not to cut or roughly manipulate in tissue not thoroughly infiltrated. The surgeon must be ready to lay down the knife and take up the syringe on the slightest expression of pain by the patient. By carefully infiltrating the skin, mucous membrane, and perirectal connective tissue, I was able to remove a large hemorrhoidal node by the clamp and cautery with insignificant pain to the patient. Stretching of the sphincter by the thumbs was attended with some pain, which the patient said, however, did not compare with that caused three days later by the first movement of the bowels which followed the operation.

I have been able to remove fatty tumors and epitheliomata, some of fairly wide extent, and other subcutaneous tumors, wens, etc., with the patient an interested spectator, and have been repeatedly told that the removal of the stitches, at the end of a week or ten days, was more painful than the original removal of the tumor. Dr. J. C. Warren has successfully removed a fatty tumor of the abdomen, of the size of a cocoanut, by this method.

In certain cases, however, in which the patient is of extremely nervous temperament, and cries out with apprehension before the knife touches him, I have found the method difficult to apply. When the patient feels such a horror of the knife as to express a wish not to know that anything is being done, then it is wiser, I think, to give ether.

With regard to the employment of infiltration anesthesia

in major operations, laparotomies, and the like, which Schleich advises, the general verdict will, I think, be against him. Severe and difficult operations it is not wise to complicate further by the addition of the inconvenient necessity of constantly stopping the operation to reinfiltrate the operative field. It is also not always desirable in these cases to have the patient a witness to the mental and physical efforts of the surgeon, even if they be attended with no pain.

In cases, however, when the condition of the heart, shock, or the danger from vomiting (for example, strangulated hernia) render ether dangerous, the infiltration anesthesia is destined, I think, to be of immense advantage. Here the surgeon is not justified in regarding the slight inconvenience of maintaining local anesthesia, in comparison with the great advantage of doing away with the general anesthetic. And by the infiltration method properly applied, without the danger of giving a poisonous dose of cocaine, a much more satisfactory local anesthesia of the operative field may be attained.

There is no reason why such operations as kelotomy for strangulated hernia, tracheotomy, resection of a rib for empyema, for instance, cannot be performed under infiltration anesthesia with little or no pain to the patient, and there is every reason why, this being true, the use of ether in cases of this class, where it becomes a serious complication, should be avoided.

In regard to the practical advantages of Schleich's method of local anesthesia, then, we can say that it has increased the safety and certainty of success in the employment of local anesthesia in minor operations, and that it has made possible the safe and comparatively painless performance of major operations in those cases in which, for any reason, a general anesthetic is contra-indicated or undesirable.

The advantages of the general anesthetic in long and complicated operations, and even in short operations where muscular relaxation is desired, — for instance, the reduction of dislocations, or of deformities due to fracture, etc., — are so great that we cannot agree with the discoverer of the method that it is destined almost to displace the use of general anesthesia.

XIII.

COMPOUND SEPARATION OF THE EPIPHYSIS OF THE FEMUR WITH TRAUMATIC OSTEOMYELITIS.

By Edward H. Nichols, M.D.

From the Sears Pathological Laboratory of the Harvard Medical School.

The following case illustrates the increased susceptibility to infection of injured bone that has been stripped of its periosteal covering. The patient was treated in the surgical wards of the Boston City Hospital. The clinical history is reported through the kindness of the surgeons who had charge of the case.

P. McD., thirteen years old, a school-boy, was admitted to the hospital June 19, 1895. One hour previous to the time of his admission he had tried to jump upon the tail-board of a moving lumber wagon, and his left leg was caught in the revolving wheel.

At the time of admission, the boy's general condition was good and he showed little evidence of shock. There was a compound separation of the lower epiphysis of the left femur from the shaft. The fractured end of the shaft projected through the wound about eight c.m., and was denuded of periosteum for about five c.m. The joint was not opened and the dorsalis pedis artery pulsated.

Under ether it was necessary to enlarge the superficial wound before the fractured bone could be reduced. The wound was cleaned, an iodoform wick was inserted at the lower angle for drainage, and the opening was closed by interrupted sutures. The leg was put up in a plaster circular, which extended from the toes to the groin.

The patient reacted well and was comfortable the next day. The wound was dressed the second day on account

of staining of the dressing, but there was no suppuration and the wound looked well. In about a week the boy began to lose ground, and two weeks after the first dressing pus was seen in the wound. The patient steadily grew worse, and amputation was advised and refused. The discharge increased and various sinuses, leading down to dead bone, were formed. Seven weeks from the day of admission there was a sudden profuse hemorrhage from the sinuses, which was controlled by packing. These hemorrhages recurred almost daily for nearly two weeks, Finally the parents gave reluctant consent to amputation.

The leg was amputated fifteen c.m. below the hip, and even then the flaps had to be trimmed and curetted to free them of the infiltrated tissue. The stump was closed, except for a drainage wick at each end. The patient immediately improved and was discharged four weeks after the operation with a firmly united cicatrix.

The amputated shaft and epiphysis were examined by the writer at the Sears Pathological Laboratory. The specimen consisted of the lower ten c.m. of the shaft with the epiphysis and articular surface. The end surface of the shaft was roughened and eroded. The sides of the shaft for a distance varying from three to five c.m. were entirely denuded of periosteum, which had been stripped back like a glove finger. Beginning at the level where the stripping of the periosteum ceased, the sides of the shaft were enlarged and irregular from new bony formation.

The surface of the epiphysis adjoining the fracture was rough, shreddy, and slightly eroded, and a small fragment of bone was torn from the internal condyle. The articular surface was smooth, shining, and apparently normal throughout. Section of the shaft showed the lower three c.m. to be spongy, with large irregular, areolar spaces. Above this area there was an irregularly transverse, dense, white band, while above this band the shaft was apparently normal, except for a considerable layer of bone, evidently newly formed periosteal bone, outside the original dense walls.

On microscopic examination the articular cartilage appeared normal. The marrow of the epiphysis in which the

cell elements predominated ("red marrow") was normal to within about five m.m. of the epiphyseal line. At that level the areolar spaces began to be filled partly with young connective tissue containing numerous large vessels ("granulation tissue"). Then came a transverse band of dense fibrous tissue completely filling the areolar spaces. Between this fibrous band and the line of fracture was a layer of lymphoid cells and of polynuclear leucocytes.

The shaft of the femur for the distance of over three c.m. above the epiphyseal line was entirely necrotic, the cells were fused into a faintly staining granular mass, and the trabeculæ showed neither laminæ nor bone cells. This necrosis was less marked the greater the distance from the epiphyseal line. Above the area of necrosis was an irregular, obliquely transverse band of dense fibrous tissue, the fibres of which completely filled the areolar spaces, while the trabeculæ were mostly necrotic. In places the fibrous tissue was œdematous and enclosed large numbers of lymphoid cells and polynuclear leucocytes.

Outside the original shaft of the femur, beginning a little below the level of the band of fibrous tissue just described, was a wide layer of newly formed periosteal bone, having numerous trabeculæ, whose surface was covered by many bone-forming cells (osteoblasts), while the areolar spaces were filled with young connective tissue cells and osteoclasts.

Above the transverse band of fibrous tissue the marrow was normal.

With Weigert's stain many colonies, large and small, of cocci, apparently staphylococci, could be seen scattered throughout the necrotic lower end of the shaft. In the transverse band of fibrous tissue no such colonies could be seen, nor did they appear in the normal marrow above the band. In the epiphysis only a very few colonies could be found, and in all cases the colonies were outside the band of fibrous tissue.

From a consideration of the case it seems certain that it would have been impossible to avoid infection. The lower end of the shaft, stripped of periosteum, its blood supply cut

off, and its vitality lowered by injury, inevitably must have become necrotic and been separated as a sequestrum. This necrotic bone yielded easily to a slight infection. It is probable that, if the periosteum had not been stripped, the bone would have been able to resist infection, for the epiphysis did resist infection, except directly along the edge of the line of fracture, while the shaft at the level where the periosteum was intact, completely walled off the bacteria. The walling off of so extensive and active a process indicates that the infection came late, after the process of repair was well advanced.

The case suggests that it may be desirable, in such a case of extensive stripping of the periosteum, to attempt to replace the lacerated periosteum, or, if that is impossible, to excise the denuded bone, since the resulting shortening would be of less consequence than the practically certain infection with its attending dangers.

XIV.

NOTES OF CASES OF CRIMINAL ABORTION.

By F. W. Draper, M.D.

I. — Margaret O., 19, single, died October 6, after an illness of eleven days. It appeared by the statements of the girl just before her death and from facts otherwise obtained, that having missed two catamenial periods, and believing herself pregnant, she induced her lover to go with her to a "magnetic" adventurer in a neighboring city, and to arrange for the induction of a miscarriage. These preliminaries having been adjusted, and a money consideration of fifteen dollars having been promised by the man, the girl went, by appointment, September 26, and received her first "treatment." This operation consisted of the passage of "a current" through the womb, a tube like a rectal bougie being passed into the vagina, to cover and carry one pole, while the other pole was a wet sponge placed over the abdomen. After the application of the electricity had been made, the girl received an enema, and was given a pint of spearmint tea to drink. The electrical operation gave her much pain. A portion of the contract money was paid, and, after an injunction to the girl to keep silent as to the operation, she was dismissed. She returned to her home and began to flow the following night; this continued during the next forty-eight hours, but nothing recognized as a fetus came away. She went out on the fourth day after the operation: on the fifth day more pain and flowing kept her at home, but on the sixth day she went to her employer's store, and on the seventh day she attended church. On this seventh day she had chills, but she kept about and did not surrender to her increasing illness until the ninth day, when she went to bed, with much abdominal pain and

recurrent chills. Next day she was seen for the first time by a physician, who found fully developed peritonitis, with a temperature of 105°, vomiting, tympanites without great pain or tenderness, constipation. She sank steadily, and died in the evening of the eleventh day after the operation.

Autopsy. — The body had been kept in ice, but there was no rigidity sixteen hours after death. The breasts were well developed, without any pigmentation of the areolæ or enlargement of the areolar tubercles. A little thin, milky fluid appeared on the nipples when they were pressed. The abdomen was tympanitic.

The external genitals were rather swollen. A little dark, thin, fetid matter exuded from the vagina. The ostium vaginæ was not dilated. There were some superficial abrasions at the inferior end of the right labium minus and on the fourchette. The remains of the hymen were distinct.

The heart and lungs were normal.

There was general, acute, purulent peritonitis. In the pockets made by the agglutinations of opposing intestinal folds and adjacent visceral surfaces, thin, very fetid pus had collected, to the amount of nearly a quart. The blood-vessels of the peritoneum were everywhere injected, but the intensity of the inflammation appeared greatest in the pelvis.

The spleen, liver, and kidneys were normal.

The stomach contained four fluid-ounces of dark, grumous matter, of fluid consistency. The gastric and intestinal mucous membrane was of healthy aspect.

The pelvic organs were much agglutinated throughout their peritoneal surface. The vagina showed a discolored surface without any local sign of violence. The os uteri admitted the tip of the little finger; around this orifice were limited ecchymoses, and at the right angle was a small abrasion. The womb was perceptibly, though moderately, enlarged; its cavity was three inches deep, measured from the external os. The canal of the cervix was reddened. At the internal os were two excavated ulcerations, one anterior, the other posterior in situation; they were nearly alike in size, five-sixteenths of an inch in diameter, and

one-eighth of an inch deep; their edges were ragged and irregular, with an outline nearly circular; the color of the base and edges was nearly black. A section of these ulcerations (which probably represented eschars resulting from the primary electrical operation) showed that they rested on a reddened tissue of uterine muscle one-sixteenth of an inch in depth.

The placental site was found as a raised and reddened area on the anterior wall of the uterine cavity, about one inch in diameter. The mucous membrane of the cavity was covered with gray, creamy pus. The uterine wall was from half an inch to one inch in thickness; section showed the sinuses well developed.

There was double purulent salpingitis.

The right ovary displayed, on section, a typical *corpus luteum* of the size of a large pea.

The bladder was of healthy appearance.

The meningeal blood-vessels were injected. The brain was normal.

II. — Abby H. J., 30, married four years, and the mother of a living child three years old, found herself again pregnant. Her first labor was not especially difficult, but it was reported that the attending physician had warned her that she ought not to bear any more children, because she had a lateral curvature of the spine in the lower dorsal and upper lumbar regions. When she was a little more than five months advanced in the present pregnancy, she visited the office of Mrs. X., the successor in business of a notorious abortionist at that time in the hands of the law. Mrs. J. was under the escort of her husband at this visit, but she prudently left him on the sidewalk while she interviewed Mrs. X., and made an appointment for another call. A week later, she went again to the office of Mrs. X., this time being accompanied by her sister. Except her pregnancy she was in perfect health. Mrs. X. took Abby into an inner room, leaving the sister in a waiting-room. In a few minutes, hearing some confusion in the adjoining room, the sister invaded its privacy and saw Abby flat on her back on the floor; there was no sign of life except a little

gurgling noise in the throat. On the carpet by the patient's feet was a "silver thing, about five inches long, and of the size of a pencil." The sister, alarmed, went hastily to find and fetch the husband. On their return the doors were locked; but Mrs. X. soon appeared with a doctor whom she had called from his office nearly a mile away. The husband and sister were informed that Mrs. J. was dead; and when the husband asked how it happened, the reply was that Mrs. J. "sat down on a chamber vessel to make her water, and she suddenly went over on the floor." There was some talk about heart disease and about the removal and burial of the body. But the husband and sister, on visiting an undertaker, received wise counsel, and on his suggestion informed the police, who promptly took action.

The body was found lying on its back, with the clothing loosened and the corsets off. There was some froth at the nostrils. The genitals were found uncovered, and the feet were separated to the extent of eight inches. In the room where the body lay was a variety of gynecological instruments, dressings, and drugs.

Autopsy. — The body was examined eighteen and a half hours after the death, having been kept in a cold room during the last twelve hours of that period.

Rigor mortis was fully developed.

The tip of the tongue was engaged between the teeth.

The breasts were flat; the areolæ were pigmented; there was colostrum in the nipples.

The abdomen was prominent, and within its flaccid walls a large, soft, globular mass could be felt just above the pubes.

The external genitals showed no sign of injury. The vaginal orifice admitted three fingers. There was no vaginal discharge.

When the usual incision was made over the sternum, the divided blood-vessels gave vent to some dark, fluid blood, without bubbles.

In the pericardium there was half a fluid-ounce of clear, thin serum.

The heart was of normal size. The right auricle and right ventricle were distended. The left ventricle was firmly contracted. The wall of the right cavities was very elastic and yielding; no crepitation was felt under pressure. When a slight puncture, half an inch long, was made in the anterior wall of the right ventricle, there was a puff of air, without any odor; then some dark, fluid blood followed; and then some bloody bubbles, coarse and fine, welled out in large amount. The desirability of opening the heart under water was considered, but the advanced position of the organ, as the result of the spinal deformity, rendered this impracticable. The left ventricle was empty. The valves in both sides of the heart were normal in all respects.

The lungs showed some hypostatic reddening, but the general aspect was normal, and the anterior and upper parts were pale.

In the pulmonary arteries, in both lungs, were many bloody bubbles, even the smallest branches containing them.

The spleen, pancreas, œsophagus, stomach, and intestines were of normal appearance,

The liver and kidneys were somewhat injected; there was no appearance of bubbles in their blood-vessels.

The mesenteric vessels were injected, and some of them showed bloody bubbles through their walls.

The inferior vena cava and its branches displayed many air-bubbles, the vessels being inflated and showing alternating collections of bubbles and blood.

The aorta was empty.

The pelvic organs were carefully examined before their removal. The womb appeared as a globular tumor, of the size of a foot-ball; it extended nearly to the level of the navel. It measured eight and a half inches from os to fundus (externally) and six and a half inches in width. Its sinuses were prominent, standing out from the surface as elastic, cord-like canals, through whose walls columns of air were plainly visible, and were displaced, to and fro, under light pressure. The color of the surface was pearly-white anteriorly, red laterally and posteriorly. Through

the uterine walls, fetal limbs and outlines could be easily felt. The pelvic veins at each side of the womb contained air-bubbles.

The vagina was pale, and was free from all signs of traumatism.

The os uteri admitted the tip of the little finger. A small plug of yellowish, viscid mucus depended from the orifice. Around the external os, the mucous surface was abraded to a width of three-eighths of an inch, and showed some blood-stained bruising.

The bladder and urethra were normal. An incision carried along the anterior wall of the womb, from the external os to the fundus, exposed the following appearances: The canal of the cervix was reddened and bruised in its upper half; below this it was of natural aspect. The cavity of the womb contained a fetus in its unbroken amniotic sac. This was easily turned aside; on its posterior surface was an area two inches wide, which was blood-stained, and represented separation during life. A thin clot of blood lay between the membranes and the uterine wall; this clot was small, not above half a teaspoonful in amount. In the uterine wall itself, at this point, were four lesions: a rent, one inch long, was found just above the internal os, transverse in direction; immediately above this was another transverse tear, half an inch long, with the bridge of decidual tissue between the two rents raised and separated from the underlying parts; a quarter of an inch higher was a round abrasion of the size of a large pea; and, finally, an inch and a half higher, was a separation of the lower edge of the placenta, the laceration here being an inch and a half long and a quarter of an inch wide. The placenta was four inches in diameter, and occupied the middle uterine zone, posteriorly.

The uterine sinuses were fully developed in the muscular wall, some of them being larger than a goose-quill. Air blown into one of them was observed to issue from the placental laceration above described.

The left ovary was of normal size and appearance; the right ovary contained a fully developed *corpus luteum* of

the size of a filbert: its centre was a decolorized pearl-white clot; its convoluted wall was one-sixteenth of an inch thick. The tubes were normal.

The amniotic sac held a male fetus, normally formed, eight inches long and weighing eight ounces.

The brim of the pelvis measured in its conjugate diameter four and a quarter inches, and in its transverse diameter, four inches: at the outlet, the antero-posterior diameter was four and three-quarters inches. Though slightly twisted from its normal planes, it did not present any obstacle to normal delivery at term.

The scalp, skull, meninges, and brain showed nothing abnormal.

III. — Eliza M., 19, single, pregnant between three and four months, submitted herself to an operation, to induce a miscarriage, in the afternoon of December 1, or the following morning. She remained at the house where the operation was performed. She flowed December 2 and 3. She complained of lameness, pain in the head, and fever, on the 3d. On the 4th she was delirious. On the 5th a physician was called, who found the patient so dull and "thick of speech" that he was unable to obtain any satisfactory statement from her. Her temperature was 102°; her pulse was 140. When he moved her limbs, or touched them for examination, she cringed with pain; but she would not, or could not, answer the simplest questions. Her knees were swollen. There was no vaginal discharge and no suggestive fetor. A digital examination was made: the os uteri admitted his finger. This condition aroused his suspicions, but he was unable to find any satisfactory evidence to corroborate them. Another physician was called in consultation, who, while sharing his suspicions, agreed with him in the diagnosis of "rheumatism with typhoid symptoms."

The stupor deepened into coma, and the girl died at 9.20 P.M., December 7.

Autopsy, 17 hours post mortem: The body was well nourished. There was no cadaveric rigidity. The skin was pale. There was no sign of injury about the vulva.

The ostium vaginæ admitted two fingers. There was some excoriations of the nates and of the skin over the sacrum.

The heart was of normal size. On the anterior surface of the left ventricle, near the apex, was an area, slightly raised, of a bright red color, of irregular outline, which a dime would cover; it was superficial, and did not involve the muscular tissue. The right auricle and ventricle were well filled with partly decolorized clot. The mitral valve admitted three fingers. At its right edge, the free border was reddened, slightly swollen, and superficially ulcerated. Attached to this reddened border was a narrow, ribbon-like clot, whose free end trailed into the middle of the left ventricle, with firm adhesions here and there in the chordæ tendineæ. The aortic and pulmonary valves were normal.

There were two punctate ecchymoses in the pericardium.

The veins on the surface of the heart were injected.

The lungs were normal.

The spleen was enlarged to twice its normal size: it was softened almost to diffluence. In its substance were three infarctions, one occupying nearly one-third of the volume of the organs, the others being much smaller; they were all of a dull pale yellow, rather firm and homogeneous, showing an irregular but distinct limiting periphery.

The stomach, pancreas, and intestines were normal.

The liver showed no change except some limited areas of anemia beneath the capsule.

The kidneys were moderately swollen and softened. The cortex was pale, the medulla red. In the latter were numerous minute white foci, and in the right kidney was a large infarction, involving fully one-quarter of the organ, showing its base at the surface, beneath the capsule, and extending nearly to the pelvis of the organ, its limiting wall being marked by an irregularly defined reddish line, having the general shape of a wedge or cone with the apex at the deepest part.

There was no sign of inflammation or other alteration of the peritoneum.

The vagina was free from trauma.

The bladder was empty and of healthy aspect.

The womb measured three and three-fourths inches long and three and one-half inches wide. There was no sign of wounding. The os uteri admitted a finger: its edges were everted, red, bruised, but not greatly swollen. The cavity was empty. The mucous membrane of the endometrium was covered with foul-smelling, thick fluid, reddish gray and easily washed away. The placental site was on the posterior wall, a raised and roughened area an inch and a half in diameter.

The Fallopian tubes were reddened externally, and their canal contained mucus, with some creamy pus toward their free ends.

The left ovary contained a *corpus luteum* of the size of a filbert: its wall was thick and its central cavity small.

The scalp and skull were normal. The blood-vessels of the meninges, both dura and pia, were fully injected, and the surface of the brain under the dura had a distinctly reddened aspect: on the surface of the left hemisphere, just behind the upper third of the fissure of Rolando, was a group of small red elevations with white points at their apices. Section of the brain found numerous *puncta cruenta*. In that part of the roof of the right lateral ventricle above the middle of the corpus striatum, deeply situated in the white substance of the brain, were two centres of disorganized tissue, softened to diffluence at their middle, without reddening, and without distinct limiting wall: each of these was of the size of a cherry. In the left hemisphere, in the white substance above the optic thalamus and about an inch from the roof of the lateral ventricle, was another centre of white softening like those just described. In the left optic thalamus, just behind its centre, was a well-defined infarction of yellowish color, rather firmer than the adjacent tissue, without any appearance of disintegration: its size was that of a large beech-nut.

IV. — Rosa A. L., 34, single, died at five o'clock A.M., December 1: on the 12th or 14th of the previous month (there is some uncertainty with reference to the day) she visited a "physician" for the purpose of having "a tumor" removed from her womb. November 22, her neighbors

first learned that she was confined to her bed by sickness, and that she was not having proper care; and on that day, as the result of their interest, a medical attendant was secured. What had occurred between November 14 and November 22 is not known. The physician learned from the woman that she had been suffering from "rheumatism," and had been in bed all the time for a week. He found much abdominal tenderness, a weak, irregular pulse, a high temperature, and constant nausea; asked about her menstruation, she said that she had been perfectly regular, and had just recovered from a monthly period. He made no vaginal examination.

Two days later, the first physician was dismissed and two others were called. To one of these the history of rheumatism was again related, with the additional fact that the abdominal symptoms had begun two or three days before his first visit. He found abdominal tenderness and distention; temperature 104°; right arm and both legs much swollen and very painful; persistent vomiting; suppression of urine.

At his next visit he was told of her delirium in the previous night; he found her unconscious; in other respects her condition was unchanged. He failed to ascertain any fact suggesting a recent miscarriage. Before his call the following morning she was dead.

Autopsy, twenty-eight hours post mortem: The body was spare. The skin showed a marked sallow hue, generally diffused.

The abdomen was moderately distended. Both knees were swollen. There was edema of the shins.

The heart was normal. The lungs were normal, with moderate hypostatic reddening. Some fresh adhesions of intestinal loops in the left iliac region were easily broken. Deposits of fibrinous exudate were found on the surface of the spleen, the liver, and along the intestinal loops in the left iliac region.

The spleen was enlarged to double its normal size: it was red and soft, showing two pale yellow infarctions, irregularly cone-shaped, homogeneous, with narrow limiting red line at their periphery.

The stomach and pancreas were normal.

The intestines (about the middle of the ileum) showed four small infarctions, appearing as slightly raised red areas of the size of grape seeds; they were situated in the mucous membrane, and on section presented reddish-yellow contents.

The liver was enlarged; injected; with two infarctions, both in the larger lobe, each showing a dark, nearly black irregular base within the capsule, and presenting, on section, a rather firm, cone-shaped, dark yellowish-red, well-defined area, with a narrow, reddish, limiting boundary line. In other respects the organ was healthy.

The kidneys were enlarged and soft; their capsules came away readily, leaving a smooth surface. Section showed numerous, minute purulent depôts in the medullary portion, and some small infarctions in the cortex. The general aspect of the organs was pale. The anatomical elements were well defined.

The great blood-vessels were of healthy appearance.

The condition of the blood was much altered by embalming fluid which had been injected immediately after the death.

The scalp and skull were normal.

The brain and its meninges were fully injected. At two points on the surface of the right hemisphere, on its posterior aspect, were small, bright red, irregular areas, invading the cortex to the depth of one eighth of an inch.

The vaginal mucous membrane was smooth, and showed some irregular reddish discolorations.

The uterus was five and one-half inches long and four inches broad, externally. On its surface was a deposit of fibrin, easily detached. There was no sign of trauma.

The os uteri admitted the finger easily; its edges were bruised, swollen, and discolored.

The cavity of the womb was empty; its lining was covered with a grayish, quite dense deposit, removed with difficulty from the subjacent tissue; upon this exudate was a foul-smelling, dark red fluid of creamy consistency. At one point on the left side of the uterine cavity there was a pro-

jection of the endometrium of the size of half a filbert; on section, a central, red, homogeneous, rather dense kernel was disclosed.

A placental site, two inches in diameter, raised, ragged, blood-stained, displaying placental elements, was found on the rear wall near the fundus.

The bladder was empty; it showed much reddening of the urethral mucous membrane.

The left ovary contained a *corpus luteum* of the size of a small cherry; its central cavity was obliterated by the development of a thick convoluted wall. The right ovary was normal.

V. — In a village more than fifty miles from Boston, a widow, forty-two years old, the mother of two adult children, found that as the result of indiscretion she was pregnant. She had not lived with her husband for several years before his death, and it is inferred, but not proved, that an unmarried man, a neighbor, was a partner with her in pseudo-marital performances, the bitter fruits of which she alone was compelled to endure; from him she borrowed the money to pay the expenses of her journey to Boston. She left home under the false pretence that her purpose was to visit some friends in an adjacent town; her real purpose was to consult some abortionists whose advertisement she had seen, and to these Boston professionals she applied for treatment. A week after her departure from home a room was hired for her occupancy at a distance from the abortionist's office. A week later a regular physician was summoned to these lodgings to attend the woman, then very sick. To him she said she had a pain in the heart, attended with pain in the left arm. No physical examination was made, and on her death, shortly after this brief interview, the physician last called certified that "angina pectoris" was the fatal disease, and the body was hastily and cheaply buried under an assumed name, and with scant ceremony. The abortionist sought out the woman's friend and financial helper in the distant country village, told him what had happened to the widow, and counselled him to keep quiet till some time in the indefinite future, when proper papers would be sent to explain to the dead

woman's children the cause of her mysterious disappearance. Two months later, the friend, uneasy and impatient because of the delay, wrote to the abortionist, reminding him of his promise. This communication fell into the hands of the Boston police department, and became the key which unlocked the entire plot of the tragedy.

The body was exhumed and identified. Decomposition had been diligent but not destructive. The face was covered thickly with a gray pulverulent mould. The soft parts were dry and shrunken. The eyes had disappeared. The hands and feet, like the face, were dry and mouldy. The odor was penetrating, and lingered long in the memory. There were no larvæ. The parts which were covered with clothing were not so far changed by putrefaction as to be of no use for definite conclusions. The breasts were flat, without areolar pigmentation: pressure upon the nipples caused a yellowish creamy fluid to exude. The abdomen was moderately distended. The vulval mucous membrane was of a uniform dull red color; there were no traumatic lesions. The ostium vaginæ admitted four fingers.

The heart was of normal size; its aortic and pulmonary valves were translucent, elastic, and entire; the mitral valve was normal; the cardiac cavities contained masses of altered blood-clot; the coronary arteries were of full size, with smooth, healthy walls.

The lungs were decomposed.

The spleen, stomach, pancreas, intestines, liver, and kidneys were considerably altered, but showed no appearance reasonably attributable to disease. The stomach contained some small, broken masses of curdled milk; its mucous membrane was smooth and pale.

The womb was enlarged to the size of a large fetal head. Its color was light red. There were recent, easily broken adhesions in the fossa of Douglass: in the act of separating these and removing the organ, a collection of pus was found, mostly gathered under the left broad ligament; its amount was about half a fluid-ounce.

The vagina was dilated and reddened. At a point half an inch below the os uteri there was a group of four punctured

wounds, round, admitting a large probe. A small catheter, passed into one of these punctures, took a direction upwards and backwards, and emerged in Douglass' fossa, just below the level of the os internum. The other punctures were explored, and found to be superficial.

The os uteri admitted two fingers readily, and three with a little forcing. Its tissue was shreddy, ragged, and blood-stained, and showed lateral tears extending nearly to the outer edge.

The womb measured seven inches long and five and a half inches broad externally. Its depth internally, from os to fundus, was six inches. Its cavity was empty, showing a dark brown, nearly black surface, with the placental site raised, rough, three inches in diameter, placed posteriorly near the fundus. The wall of the womb was thick and pale.

The right ovary contained a *corpus luteum* of the size of a filbert; it had a thick, yellow, convoluted wall, and a central decolorized clot of very small dimensions. The left ovary was missing; in its place was a tumor, of the size of a large plum, elastic, containing a quantity of thick, whitish fluid, a bunch of coarse brown hair, two incisor teeth (one lying loose, the other attached to the cyst lining), and other minute bony fragments.

The Fallopian tubes did not show any abnormal change.

The scalp and skull were free from disease or injury. Decomposition had so far affected the scalp that the hair came out freely on slight traction. The brain was diffluent, and showed advanced putrefaction, much beyond the degree apparent in any other organ.

These cases are examples of the anatomical problems which the abortionist supplies for the medico-legal pathologist. They illustrate the difficulties which obstruct the way to conviction and punishment. In nearly every instance the autopsy is helpful, but is entirely inadequate to prove that an abortionist's interference with the pregnancy was the clear cause of the death. The usual experience is that one finds satisfactory evidence of a recent miscarriage and

of sepsis as its consequence; but the demonstration of an instrumental interruption of the pregnancy is wanting. The most that the medical examiner can declare, under these circumstances, is that his observations lead to conclusions which are consistent with the presumption that the miscarriage was induced by the careful passage of a catheter, or some similar instrument, into the womb; but that presumption must rest on data which must be found, if found at all, by detective skill of another sort. Too often the researches in this latter direction are baffled. It is sometimes possible to determine when and in what way the abortionist accomplished his or her work; but the identity of the criminal agent and the place where the act was performed remain impenetrable secrets. Even the dying declarations of the victims of the crime are subject to such exacting legal conditions that they often fail to have value as evidence: if the woman's mind is not unreservedly convinced that death is at hand and inevitable, if any hope of recovery, no matter how small, lingers and finds expression, then her statements are of no service as a help to convict the abortionist.

To this description of the circumstances which give the abortionist immunity, one exception should be appended. If, in the course of the passage of an instrument into the pregnant womb for the purpose of inducing an abortion, uterine sinuses are opened, and the accident of air embolism results (as in Case II.) in the immediate death of the passive partner in the crime, the anatomical appearances have a chance to be of great value. They can show conclusively that the unlawful procedures which have been undertaken in the case were identified with the time and place of the woman's death, and they make the dead and undelivered woman as good a witness against herself and her abortionist ally as she could be if she were living.

XV.

AN EXAMINATION OF ONE HUNDRED CASES OF DISEASE OF THE HEART, COLLECTED FROM THE AUTOPSY RECORDS.

By Henry Jackson, A.B., M.D.

With the view of determining the etiological factors in the causation of various disturbances of the heart, and especially the rôle played by lesions of the valves in patients presenting the clinical phenomena of "Cardiac Cases," I have examined the autopsy records of the hospital, covering a period of eighteen months. I have taken each case consecutively, where mention was made of any pathological lesion of the heart, until I have accumulated a series of one hundred. Many of these cases represented merely a pathological process, as fatty degeneration or cloudy swelling, and in some there is evidence of slight valvular lesion which in no way could have interfered with the efficiency of the valves during life.

Many patients present themselves with a history of shortness of breath, dyspnœa, perhaps, cough, cyanosis, in whom physical examination demonstrates enlargement of the heart, and irregular or rapid action, but in whom we find no valvular lesion to account for the condition of the heart. These cases are variously classified as "Cardiac," "Weak Heart," "Dilated Heart," "Parietal Disease" of the heart; perhaps any one of these terms is as desirable as another, as we do not and can not commit ourselves in all cases as to the diagnosis of the pathological lesion present. This investigation suggests the probable pathological cause in a good many such cases. On the other hand, with what certainty may we diagnose an organic valvular lesion from the presence of distinct, well-marked murmurs?

In the fifth series of medical and surgical reports of the

hospital I have tabulated ninety-two cases of disease of the heart seen in the Out-patient Department. In this series I made the diagnosis of non-valvular disease, or, as I then suggested, following the nomenclature of Dr. Gannet, parietal disease of the heart, in forty-eight cases; valvular disease, thirty-nine cases. It is my wish, in the following collective examination of post-mortem results, to determine what relation the pathological data as to disease of the heart bear to diagnoses made during life.

I have collated from the autopsy records the following data as to the heart: namely, weight, hypertrophy, dilatation or both; the condition of the coronary arteries; condition of the arteries of the body in general, valves, kidney.

The hundred collected cases may be classified as follows:

Valvular disease	34 cases.
Valvular disease with adherent pericardium .	4 "
Adherent pericardium without valvular disease	1 case.
Lesion coronary arteries and arterio-sclerosis .	32 cases.
Fatty and acute degeneration of the myocardium,	16 "
Renal disease	5 "
Chronic lung-disease	4 "
Disease of myocardium	4 "
Total	100 "

In eight of the cases of chronic valvular disease there was associated an acute verrucous endocarditis. There were also five cases of acute verrucous endocarditis in which there was no chronic valvular disease. Of these latter three occurred in septicaemia following surgical operation, one in acute lobar pneumonia, and one in diphtheria. There were two cases of acute ulcerative or malignant endocarditis.

Examination of the table of the weights of the thirty-four cases of valvular disease shows that in twenty-three cases where the weight is given seventeen hearts weighed five hundred grammes or less. In seven cases the heart was not enlarged. Comparing these figures with the weights of the heart in twenty-seven cases of sclerosis where the weight

is given, we find that on the average arterio-sclerosis causes a much greater enlargement of the heart than valvular disease. In the latter class of cases, twelve hearts weighed more than five hundred grammes, and in twelve of the cases the weight was over five hundred and fifty grammes, the heart weighing eight hundred grammes or over in two instances. In only three instances did the weight exceed five hundred and fifty grammes, in enlargement due to valvular disease.

The largest hearts are found in cases of adherent pericardium, in one instance the heart reaching the enormous size of thirteen hundred grammes, though in these cases it is impossible to give the exact size of the heart, as the pericardium was necessarily included in the weighing.

The table gives sixteen cases of acute degeneration or fatty degeneration of the myocardium, eight of the cases showing no enlargement, or only a slight enlargement, while in eight instances the heart was sufficiently enlarged to give rise to an increased area of dulness during life: in four of the cases the enlargement of the heart was recognized during life by the increased area of cardiac dulness. The other cases occurred in acute septicaemia, where the gravity of other more important symptoms drew attention from examination of the heart.

Two large hearts were found in renal disease, and two in chronic pulmonary disease, where there was no arterial or valvular lesion associated to cause any disease of the heart muscle.

Five cases of adherent pericardium occur in the list, and in all there was great enlargement of the heart itself. In these cases the weight alone is, of course, deceptive, as the pericardium was necessarily included in the weight of the heart. In one of these cases the heart and pericardium together weighed one thousand three hundred grammes, in another one thousand and ninety, while two others in which the weight is given weighed over eight hundred grammes.

In four of the cases of adherent pericardium there was also valvular disease; in the fifth case there was no valvular

lesion — the heart was slightly hypertrophied and dilated. During life the heart presented no signs of an abnormal condition, death resulting from acute appendicitis with subsequent septicaemia.

Four cases I have designated as unclassified: one, a syphilitic myocarditis in which no valvular lesion was found, and no disease of the arteries: one, a pathological curiosity, in which multiple sarcomatous tumors were found in the heart in a case of multiple sarcoma of the skin: two cases of acute myocarditis, in one of which sudden death followed rupture of the ventricle. One heart, weighing five hundred grammes, was found in a case of chronic non-tubercular pulmonary disease, the pathological diagnosis of carnification with gangrene of one lung being made.

TABLE I.

Weights of the Heart.

	Valvular.	Sclerosis.	Fatty or Ac. Deg.	Renal.	Chr. Lung.
300–350	5	4	1		
350–400	3	3	4	2	
400–450	1	2	5	.....	1
450–500	8	3	1		
500–550	3	4	.....	1	2
550–600	1	4	2	1	
600–650	1	4			
650–700	.....	1			
750–800	1	1			
820	.....	1			
Large	4	5	.....	1	1
Not enlarged	7	.....	3		
	34	32	16	5	4

Adherent pericarditis with valvular lesion, 900, 800, 1,300, 1,090.

Adherent pericarditis without valvular lesion, "much enlarged."

Syphilitic myocarditis, 490.

Unclassified multiple sarcoma, "enlarged."

Two cases acute myocarditis, "not enlarged."

In seventy-five cases the weight of the heart is given. In twenty-seven of these cases the cause of the enlargement was valvular disease, including the four cases in which there was in addition to the valvular disease an adherent pericardium. In forty-seven cases the cause of the enlargement was found outside the heart itself. In twenty-seven of these cases the cause of the heart trouble was arterio-sclerosis or disease of the coronary arteries, the two affections being associated in almost every instance.

From a study of these seventy-five cases we may say that practically, in enlargement of the heart, we have always the two factors, — hypertrophy of the muscular substance of the heart, and dilatation of its cavities. In eight cases of the seventy-five the heart is spoken of simply as hypertrophied, though in none of these cases is the positive statement made that there is no dilatation of the cavities; in three of the eight cases the enlargement was so slight that it would have given rise only to a slight increase of the size of the heart as determined by percussion. Fraentzel, in his monograph on the heart, insists strongly that as clinicians we must bear in mind that an enlargement of the heart sufficiently great to cause an increased area of dulness in the living indicates dilatation of its cavities.

From these statistics it appears that it is difficult to recognize an increase in the size of the heart unless the heart weigh four hundred grammes or more. Of eighteen observations as to the size of a heart that was shown post mortem to weigh four hundred grammes or less, enlargement was diagnosed during life in only three, while enlargement was diagnosed in five out of eight cases where the heart weighed four hundred and fifty grammes.

We may therefore draw the lesson from pathological data that when by physical examination we can diagnosticate an enlargement of the heart, we have already a certain dilatation of its cavities, and are to watch carefully to determine the time when the compensatory hypertrophy is beginning to fail, and we must, with the aid of various drugs, step in to assist nature to fight against the obstacles which are already beginning to overpower the heart.

VALVULAR CASES.

A review of the clinical histories of the cases of valvular disease is satisfactory as to the correspondence of the clinical diagnosis with the results of post-mortem diagnosis. In five cases the records state that the heart was normal where there was found post mortem a "thickening" of the mitral valve. In all of these cases there was very slight enlargement, the heart in no instance weighing over three hundred and fifty grammes. During life there were no symptoms suggestive of cardiac disease, the patient dying of some intercurrent process in no way connected with the heart.

Apparently the lesion which most frequently escaped observation was aortic disease, combined with insufficiency of the mitral valve: four of these cases are noted, and in one the aortic lesion is described as extreme stenosis. Three cases of mitral stenosis were not recognized, the only sign during life being a systolic murmur at the apex: this lesion is certainly the most difficult of diagnosis, and often exists without giving rise to a murmur. In another case of mitral stenosis, no murmur was heard, but the lesion was appreciated, as at one time during the patient's stay in the hospital a marked presystolic thrill was developed, though not present at the entrance of the patient. One case of aortic stenosis occurred in the case of a very anaemic girl who died of ulcer of the stomach: no enlargement of the heart was diagnosticated during life, as emphysema of the lungs obscured the area of the heart dulness, and there were no symptoms suggestive of heart disease: a systolic murmur was heard at the base, but was considered to be haemic.

An interesting case of acute ulceration of the pulmonic valves was not diagnosed: the heart was slightly enlarged: a diastolic murmur was heard loudest at the left edge of the sternum: the man had many slight chills and an irregular temperature as seen in septicaemia; there was pulmonary tuberculosis, and it was considered that the fever and chills were dependent upon the tubercular condition.

From the clinical records it is difficult to determine the relative accuracy of percussion in diagnosing the size of the heart; in most cases the records state that the area of dulness was increased or extended a certain distance beyond the nipple. In one case, where the heart weighed nine hundred grammes with the adherent pericardium, the dulness extended two inches to the right of the sternum and one inch to the left of the nipple on the left. Interesting statistics might be obtained as to the ratio of cardiac dulness during life to the size of the heart if the area were carefully mapped out by percussion, and the breadth of the area in centimeters noted.

The following table shows the frequency of the various lesions:

Aortic and mitral valves . .	17 cases.
Mitral alone	13, including four cases where sclerosis was noted post mortem.
Mitral aortic, and tricuspid .	2 cases.
Aortic valve alone . . .	5 cases, including one of marked stenosis.
Pulmonic valves . . .	1 case. (Acute ulcerative endocarditis.)

Of twenty-six cases of valvular disease where a history was obtained, nine had had acute articular rheumatism, two had chronic renal disease, and four had moderate arteriosclerosis. In seven the etiology of the endocarditis was undetermined. Four cases of malignant endocarditis were noted, three occurring in acute septic disease, and one, already mentioned, in chronic pulmonary tuberculosis.

I have a record of thirty-two cases of disease of the heart dependent upon arterio-sclerosis, and in only four was the weight under four hundred grammes.

As to the etiology of the disease: in eleven there is a distinct history of great alcoholic excess; in seven, on the other hand, the statement is made that no apparent cause was found for the disease. In several of the patients the history is deficient, as they were very sick on entrance, or unconscious, so that no history was obtained. It is noteworthy that articular rheumatism had existed in only two cases. In one of these the rheumatism antedated the onset of the symptoms by eight years, and there was no valvular lesion. In the second case the sclerosis was slight, and may properly be considered as entirely independent of an acute verrucous endocarditis which came on during an attack of acute articular rheumatism, which was the direct cause of the patient's death by giving rise to a cerebral embolus. Therefore, in distinguishing cardiac disease dependent upon arterio-sclerosis from valvular disease, a history of alcoholic excess and an absence of a history of rheumatism may well be considered as of importance.

As to age, these cases do not correspond to Howard's, who reports that "the greater portion of the cases (arterio-sclerosis) were in the prime of life." Where the age is given the following data may be cited:

20–30	3 cases.
30–40	4 "
40–50	3 "
50–60	9 "
60–70	5 "
over 70	1 case.

In all of the younger individuals alcoholic excess was a marked factor as a probable cause of the disease. In one of the cases there was very slight enlargement of the heart; in four dilatation is not mentioned as existing. In the others there was general hypertrophy with dilatation of both sides of the heart. In five cases there was such a marked dilatation

of the cavities of the heart that the dilatation gave rise to a relative insufficiency of the valves demonstrable at post-mortem examination. In all of these cases there were loud murmurs heard during life.

The following is a brief history of one of these cases:

Man, 49, hard drinker. For many months he had suffered from dyspnoea marked oedema of the extremities. Heart enlarged one and a half inches to left of nipple and one inch to right of sternum. Systolic murmur at apex. Pulse irregular, intermittent, and poor. Nine months later he again entered the hospital. The symptoms had increased in severity — orthopnoea, deep cyanosis. There was a loud systolic murmur at apex, transmitted towards the axilla, a dull murmur at base in aortic region. The action of the heart was very irregular and intermittent. There was a trace of albumen in the urine with a few casts. During his second stay in the hospital he suffered from dyspnoea for the whole time, and died in three months.

Post-mortem examination. Heart eight hundred and twenty grammes, general dilatation and hypertrophy, relative insufficiency of the mitral and aortic valves, chronic passive congestion of the kidneys. (No. 20.)

This case may well be cited as a typical though extreme case of arterio-sclerosis. The man was a hard drinker; no history of rheumatism: dyspnoea increasing to orthopnoea; cyanosis; great enlargement of the heart: death. This case is a good sample of the cases in which murmurs are heard, and yet there is no valvular disease of the heart.

Several of the cases recorded died of cerebral haemorrhage, or entered unconscious; all who were in a condition to give an intelligent account of their symptoms gave a history of shortness of breath, or dyspnoea, extending over a considerable period; in several instances for years. Several of the cases were cyanotic, and orthopnoea was noted, so severe that the patients were unable to lie down in bed. In half the cases there was marked oedema and in several general anasarca. Associated with the dyspnoea were the usual symptoms of cough, expectoration, at times bloody, and the presence of rales in the chest indicative of bronchitis.

Examination of the heart: it was enlarged in sixteen cases, according to clinical observation. In six cases the heart area is described as normal. In many of the cases the action was weak, and the heart markedly irregular and intermittent. The pulse was usually weak, rapid, intermittent, and irregular, though in eight cases it is mentioned as regular and of good strength.

Murmurs were detected in ten of the cases. In seven of these cases the murmur was situated at the apex, and was transmitted into the axilla, as is the case in the murmur of mitral regurgitation: in none of the cases was there found post mortem a pathological condition explanatory of the cause of the murmur except relative insufficiency dependent upon dilatation of the muscular substance. In one case there was a systolic murmur in the aortic area, where post mortem there was found a slight atheroma of the aortic valve which probably gave rise to a certain degree of constriction. In two cases a double murmur was heard at the aortic area, and post mortem the aortic valve was demonstrated to be relatively insufficient, as a result of the dilatation of the left side of the heart. As murmurs indicative of imperfect closure of the valves were heard in one-third of the cases of arterio-sclerosis, it is evident that the presence of such murmurs cannot be offered as evidence of structural lesion of the valves.

In sixteen of the cases a trace of albumen with casts was found in the urine. In fourteen of the cases there was structural disease of the kidney, consisting of a chronic diffuse nephritis of moderate grade, in the majority of the cases, while in three instances a small granular kidney was found post mortem.

The immediate cause of death was cerebral haemorrhage in four cases: acute lobar pneumonia causing death in four other cases. In nine cases the essential symptoms were dyspnoea, cough, cyanosis, oedema. These latter cases are, of course, the ones which interest us as clinicians.

In only a few of the cases are recorded accurate data as to the condition of the arteries; where the arteries are mentioned they are spoken of as hard, sclerotic, tortuous.

From these data we may draw the picture of arterio-sclerosis as follows:

A man of forty or more, though younger cases are seen. Alcohol used to excess. No rheumatism. Dyspnoea, cough, cyanosis, oedema, of long standing. Enlarged heart, action feeble: irregular and intermittent pulse. Murmurs present or not. Oedema. Trace of albumen with casts. Arteries hardened, tense, tortuous.

As to treatment, several of the cases had been in the hospital previous to their fatal illness, and had then improved greatly in all respects after the exhibition of digitalis, cathartics, diuretics, and especially rest in bed.

My table gives sixteen cases of fatty or acute degeneration of the muscular substance of the heart, the heart being considerably enlarged in twelve of the cases. In six of the cases the disease of the heart was secondary to acute septicaemia occurring in the course of some surgical affection or one of the acute infectious diseases. In all the pulse was rapid, irregular, and of poor strength. In none of these cases was a murmur noted, nor was enlargement of the heart diagnosed during life, the largest heart of the series weighing four hundred and twenty grammes.

One extremely fatty heart was found in a case of acute phosphorus poisoning; during life the pulse was rapid and poor: there was no murmur: the heart was not enlarged, and the fatty degeneration of the heart formed only a part of a general acute fatty degeneration of all the internal organs. I include under this classification a case of purulent myocarditis with fatty degeneration and acute fibrine-purulent pericarditis. The history of the case is as follows:

Man of sixty-nine; previous health good. For six weeks he had been sick with a fever of irregular course. The area and sounds of the heart were normal: the pulse was rapid, of poor strength, and irregular. Death occurred in four days: no diagnosis was made during life. In the areas of purulent myocarditis, bacilli were found which in shape suggested the Klebs-Loefler bacillus, though biologically they differed from these organisms.

Two of the cases of fatty degeneration occurred in cases of

pernicious anaemia: in both of the cases there was marked oedema; the heart was enlarged towards the left and murmurs systolic in time were heard. The pulse in each instance was rapid, irregular, and intermittent. Very careful examination of the heart was made in both instances, as the diagnosis was doubtful, and on both cases the entry is made in the clinical records that the area of cardiac dulness extended to the left of the nipple line: in one case the heart weighed three hundred and sixty grammes (a woman), and in the other four hundred and twenty grammes (a man).

One case of fatty degeneration of the heart was found in a case of cancer of the liver; the history was of pain in the chest, with cough and oedema, with gradually increasing pallor for several weeks. Examination showed enlargement of the heart to the left, with a murmur systolic in time transmitted into the axilla. There was no evidence of cancer of the liver during life, except that just before death there was slight pain in the right hypochondrium and moderate jaundice.

Especial interest attaches to three of the cases, there being no sufficient anatomical cause for the size of the heart in the valves, arteries, or kidneys. All were excessive drinkers. In the first case the heart weighed five hundred and seventy-five grammes, being dilated and hypertrophied. The muscular substance was pale, the arteries were normal, and the valves also were normal except for dilatation. The following is a brief history of the case:

Patient aged twenty-nine; alcoholic excess. For several weeks dyspnoea and cough. Examination showed a pale, fat, cyanotic man. The heart was much enlarged to the right of the sternum and to the left of the nipple; in action it was very irregular and feeble, no murmur being found. Dr. Councilman added the following note to the autopsy record: "This case is obscure. Death has apparently been the result of an overloading of a weak and hypertrophied heart. There was no anatomical cause, so far as could be ascertained, of heart hypertrophy. It is possible it was hypertrophied from alcohol, similar to the 'Munich heart.'"

A second somewhat similar case is recorded. A man of

twenty-six, a hard drinker, entered the surgical service on account of ulcer of the leg. Delirium tremens developed, and he died suddenly. No clinical record is made as to the heart. Post mortem the heart was found to weigh four hundred and fifty grammes, and there was marked dilatation of the right side. There was no valvular lesion and no disease of the arteries or kidney.

The third case was a man of fifty-eight years, a hard drinker. The pulse was rapid, feeble, and irregular: the heart's action was noted as turbulent, otherwise no abnormality was recognized. Many rales were heard in the chest. Post mortem the heart was found to weigh five hundred and ninety grammes: it was hypertrophied, dilated, and fatty degenerated; the valves and kidneys were not abnormal, and there was no arterial disease except a slight atheroma of the aorta. Many areas of bronchopneumonia were found, and a wide-spread bronchitis.

In all these cases it seems probable that chronic alcoholic poisoning was the cause of the disease of the heart; in that other anatomical cause sufficient to account for the pathological process was wanting.

In five cases of renal disease and in four cases of chronic pulmonary disease there was enlargement of the heart independent of other pathological processes.

The results obtained by this examination of the autopsy records of the condition of the heart itself in its relation to so-called "Cardiac Cases," and the clinical diagnosis made in the Out-patient Department, bear a moderately close correspondence. In the first series of cases the disturbance of the heart was dependent upon valvular disease in about thirty-five per cent. of the cases, and in the latter, the clinical records, in forty per cent.

The important rôle played by disease of the arteries in causing "heart disease" is seen in that this was the cause of the trouble in some sixty per cent. of the cases of disease of the heart independent of valvular lesion.

It is to be noted that the presence of murmur is not of value in eliminating organic valvular disease.

Table II.

Cases of Arterio-Sclerosis.

Case.	Sex.	Age.	Heart weight.	Hypertrophy dilatation.	Valve lesions.	Oedema.	Nephritis.	Remarks.
1	Male.	....	600	General.	Aortic thickened.	....	Granular.	
2	Male.	73	Large.	General.	No.	No.	Small granular.	Death from cerebral haemorrhage.
3	Male.	52	Large.	General.	Aortic thickened.	No.	.....	Locomotor ataxia. Death from paralysis of larynx.
4	Male.	46	560	General.	No.	Yes.	Chr. diff.	Dyspnoea. Murmur at mitral.
5	Male.	28	359	Not enlarged.	No.	Yes.	Chr. diff.	History of convulsions. Death from delirium tremens.
6	Male.	78	500	General.	No.	Yes.	Chr. diff.	Chronic pleurisy. Death from lobar pneumonia. Murmur at mitral.
7	Male.	60	360	Not enlarged.	No.	No.	.....	Death from cerebral haemorrhage. Murmur at mitral.
8	Male.	56	630	General.	No.	Yes.	Small granular.	Murmur at apex.
9	Male.	58	600	Hyp., no dilatation.	No.	No.	Chr. diff. nephritis.	Cerebral haemorrhage. Fracture. Heart not examined.
10	Male.	68	500	General.	No.	No.	.....	Dyspnoea. Murmur at apex.
11	Male.	56	Large.	General.	Aortic orifice dilated.	No.	Chr. diff.	Dyspnoea. Mitral murmur. Duller murmur at aortic region.
12	.....	.....	545	General.	No.	....	Chr. congestion.	
13	Male.	50	560	General.	No.	No.	Chr. congestion.	Partial R. hemiplegia. Sudden death.
14	Male.	....	600	General.	.....	Yes.	Fatty chr. diff.	No history. Patient died just as he entered the hospital.

15	Male.	55	510	R. heart.	Old mitral acute aortic.	Yes.	Chr. diff.	Severe cardiac pain. Anasarca. Sudden death.
16	Male.	60	Large.	General.	Relative insufficiency, aortic and pulmonary.	Yes.	Chr. congestion.	Death from cerebral haemorrhage.
17	Male.	27	490	General.	No.	No.	. . . . .	Del. tremens. Moderate art. sclerosis.
18	Male.	40	360	Slight hypertrophy.	Acute of mitral and pulmonary.	No.	Acute degeneration.	Acute art. rheumatism. Death from cer. haem. Art. sclerosis slight.
19	Male.	60	455	Dilation, right.	Relative insufficiency of tricuspid.	Yes.	Chr. diff.	Unconscious on entrance to hospital.
20	Male.	49	820	General.	Relative insufficiency, mitral and aortic.	Yes.	Chr. passive congestion.	Dyspnoea. Murmur at mitral. Double murmur at base in aortic area.
21	Male.	65	440	Moderate dilatation.	Acute of aortic.	No.	Acute degeneration.	Death from lobar pneumonia.
22	Male.	35	580	Hypertrophy.	No.	Yes.	Chr. congestion.	Dyspnoea. Sudden death. Slight murmur at mitral.
23	Male.	70	460	Dilation of right.	Atheroma of aortic valve.	Yes.	Chr. congestion.	Murmur at mitral and aortic. Emphysema
24	Male.	. . .	Large.	Especially right.	No.	. . . .	Passive congestion.	(Could not trace case in the records.)
25	Male.	21	560	Hypertrophy left side.	No.	No.	Chr. diff.	Death from inguinal affection.
26	Male.	58	380	General.	No.	Yes.	Chr. diff.	Death from uraemia.
27	Male.	40	695	General.	No.	Yes.	Chr. congestion.	Dyspnoea. Anasarca. Death from infarction lungs.
28	Male.	40	Large.	Hypertrophy.	No.	No.	Chr. diff.	Syphilis. Death. Acute lobar pneu.
29	Male.	62	770	Dilatation excessive.	Relative insuff. aortic.	Yes.	Chr. diff.	Dyspnoea.
30	Male.	51	545	General.	No.	Yes.	Chr. congestion.	Osthopnoea.
31	Male.	75	No enl.	General.	No.	No.	Senile atrophy.	Heart negative. Cancer.
32	Male.	65	No enl.	General.	No.	No.	. . . . .	Cancer prostate gland.

XVI.

THE INFLUENCE OF OVERWORK IN SCHOOL IN THE PRODUCTION OF NERVOUS DISEASES IN CHILDHOOD.

By Philip Coombs Knapp, A.M., M.D.

"Much of our school system," said Dr. Edes, in the third volume of these reports, "seems almost expressly designed for the manufacture of nervous invalids from material only too easily worked, and too abundant, in the form both of scholars and teachers." True as this criticism was, and still is, in many cases, it seems somewhat too sweeping. I have therefore studied a number of cases of nervous disease in school-children, in order to determine, if possible, how far the school system, or, rather, overwork due to that system, was responsible for the trouble.

The number of my own cases available for such study is, unfortunately, rather limited. In the first place, cases which were not suffering from distinctly nervous affections were excluded, and only those cases were considered which were still enrolled in school. Excluding such cases, I have examined one hundred and fifty consecutive cases of nervous disease in children between the ages of five and fifteen who have been under my own observation in the Out-patient Department at the City Hospital. As the severer structural diseases of the nervous system are likely to incapacitate a child from attendance at school, only a comparatively small number of such cases are included. The following table will show the various affections from which the patients suffered:

TABLE I.

DISEASES OF THE NERVES AND CORD.	Boys.	Girls.	Total.
Peripheral paralysis	3	3	6
Diphtheritic paralysis	2	2	4
Anterior poliomyelitis	2	.....	2
DISEASES OF THE BRAIN.			
Hemiplegia	5	4	9
Tumor of brain	1	.....	1
Concussion of brain	2	.....	2
Feeble-minded	4	.....	4
FUNCTIONAL (?) AFFECTIONS.			
Chorea	45	50	95
Epilepsy	6	5	11
Hysteria	4	2	6
Cephalalgia	2	3	5
Insanity	2	.....	2
Torticollis	2	1	3
Total	80	70	150

The second table shows the distribution of the cases according to age:

TABLE II.

Age.	Boys.	Girls.	Total.
5	1	1	2
6	3	9	12
7	4	7	11
8	9	8	17
9	9	5	14
10	13	13	26
11	15	2	17
12	9	5	14
13	8	10	18
14	5	6	11
15	4	4	8
	80	70	150

Above the age of fifteen so few children of the out-patient class attend school that they need not be considered.

With patients of this class, too, certain factors which tend to produce disease are more potent than with children of the better class who are seen in private practice. To the unsanitary conditions which are only too apt to obtain in our school-houses are often added the unsanitary conditions of their homes. The evils of improper feeding and of bad cooking are also more pronounced.

It is perfectly plain that the question of the causation of nervous affections in school children is far from simple. The school system may have a direct influence by compelling the child to do too much mental work, and it may and does have an indirect influence by exposing the child to bad air and unsanitary surroundings, by compelling him to remain in cramped positions on unsuitable seats and at unsuitable desks, by straining the eyes by imperfect light, by

limiting the opportunities for proper exercise, by increasing the chances of exposure to infectious disease, and by many other conditions. These indirect influences, however, although important, are due to removable causes which obtain only in certain schools, and are not due to any inherent defects in the school system itself.

In addition to the injurious factors due directly or indirectly to the school system, other factors wholly independent come into play. Heredity, injury, infectious disease, and bad food are all of great importance. Only too often, however, we see such factors ignored, and undue stress laid upon some comparatively insignificant, or at any rate subordinate, factor. We all know how the laity prefer to attribute any nervous trouble in children or in adults to a fall or to overwork, rather than to admit a bad heredity, evil habits, or an invalid brain. In children between five and fifteen two other factors have some influence. In a few instances, especially in weak, ill-nourished, or neuropathic children, the second dentition has a disturbing influence, although, with the advance in our knowledge of proper feeding and the causation of various diseases, we shall probably find that the influence of both the second and first dentition has been much overrated.

The influence of puberty is much greater. A glance at Table II. will show, however, that this is applicable in less than one-third of the cases, for in children below the age of twelve it can hardly have an influence. The influence of puberty is also overrated, for the influence of the period of most rapid growth is associated with it, and the latter must be very great. In both sexes, but especially in boys, the psychical effect of puberty often outweighs the physical. As a matter of fact, in these cases, out of twenty-five girls twelve years of age and over, only ten had menstruated, and in six the function had been established without difficulty, and had proceeded regularly and normally.

As a matter of fact, in any given case of nervous disease it is practically impossible to apportion out to each individual cause its share of the responsibility. Several causes usually work together to bring about the result, and over-

work in school is often merely the last straw. If under any given school *régime* only a part of the scholars break down, there must be some reason other than the school work why they succumb while their comrades are unaffected. In most cases a bad heredity, poor food, bad hygienic conditions at home, or previous disease will be found to have prepared the way for the nervous trouble.

It is impossible, furthermore, to lay down any fixed rule as to the amount of school work which is injurious. One child can do without effort what another child in the same class can do only by straining every nerve. Folsom[1] speaks with unqualified disapproval of double and treble promotions, but even a treble promotion may be obtained by a bright child without undue effort. Home study is also unwise, especially below the age of thirteen, but in a certain number of cases it does no harm.

In only twenty-one out of these hundred and fifty cases did the school work seem to have any influence. In one other case where there was rather too much school work, the trouble was so clearly of traumatic origin that the school work could be excluded. In four cases the influence of school work was only slight. In a case of cephalalgia with hypermetropic astigmatism, study, as might be expected, brought on the headache. A girl of twelve, with a bad heredity, had her fifth attack of chorea after worry over her school work. A boy of six developed chorea after he had been at school two weeks, and after he had received several blows on the head. A boy of thirteen had hysterical convulsions after a fright, and talked much of his school work, which had not been severe. Such cases show that school work may have an influence upon a disordered nervous system, but that the trouble is not caused primarily by the work.

In eight cases of chorea, six boys and two girls, there was more school work than was advisable, but there did not seem to be such an amount of work as very seriously to tax the children. In seven of these cases other factors were present: bad heredity, poor diet, rheumatism, or fright.

[1] Folsom, C. F. The Relation of our Public Schools to Disorders of the Nervous System. Boston, 1886.

In nine other cases of chorea, four boys and five girls, there was a history of very considerable work, involving much home study, early rising and late hours. In six of these cases there was also poor diet, bad heredity, some previous infectious disease, or overwork at home.

The following table shows that in cases below the age of ten, which form over one-third of the whole, the question of overwork plays hardly any part:

TABLE III.

Ages.	Moderate study.			Hard study.			Total.
	Boys.	Girls.	Total.	Boys.	Girls.	Total.	
9	1	.....	1	.....	.....	.....	1
10	2	1	3	1	2	3	6
11	2	.....	2	2	.....	2	4
12	1	.....	1	.....	.....	.....	1
13	.....	1	1	.....	2	2	3
14	.....	.....	.....	1	1	2	2
	6	2	8	4	5	9	17

These cases, although limited in number, are, perhaps, enough to warrant certain deductions. It is, of course, hardly to be expected that overwork in school would have any influence in producing structural changes in the nervous system, but it is of interest to note that it seems to have had as little influence in the production of epilepsy and hysteria. A second point worthy of note is, that while the ordinary result of overwork in the adult is neurasthenia, we find no case of neurasthenia in these hundred and fifty children. Although neurasthenia is one of the commonest nervous affections, forming nearly eleven per cent. of over two thousand consecutive hospital cases, it is rarely seen in children. On the other hand, in the present series of

cases we find a history of possible overwork only in cases of chorea. Chorea forms over seven per cent. of these two thousand cases referred to, but it is almost as rare in adults as neurasthenia is in children. This naturally leads us to ask whether chorea is the manifestation in the child of that condition of nervous break-down from over-strain, worry, etc., which in the adult we call neurasthenia.

I am disposed to doubt it. Among recent writers on chorea, Sachs, Gowers, Oppenheim, Blocq, and Soltmann have little to say about overwork in school as a cause: Sinkler, Osler, Dana, and Sturges, on the other hand, lay considerable stress upon it. As Sachs has stated, "the mental calibre of children who develop chorea is rather above than below par," so that we naturally see many choreic patients who are bright, precocious, ambitious, and with a natural tendency to excel in school, and to work beyond their strength. Chorea is most apt to begin in the spring, which has led many to associate it with school work, since then the child begins to show most markedly the effect of the winter's work and confinement, but Sturges admits that the bad air and unsanitary conditions of the school-room have an influence. In adults as well as in children, the effect of confinement to the house, and the impaired air of the house during the winter, are very apt to lead to a lowering of vitality in the spring. The weather, too, has some influence upon the development of the disease. In addition to this, the general trend of medical opinion is toward the belief in the infectious origin of chorea.

In the present series of cases, only nine, or less than ten per cent., of the cases of chorea gave a history of any very excessive school work, and in most of these cases other factors were also present. If, therefore, school overwork be a factor in the production of chorea, it must be of minor importance, and, as I have said, I am much more disposed to view chorea as an infectious disease than as an indication of nervous break-down from overwork, corresponding to neurasthenia.

Apart from these cases of chorea, overwork in school does not seem to have been a factor in causing nervous disease in this series of a hundred and fifty cases. This

corroborates, so far as a limited number of cases can, the opinion of Charcot [1] that up to the age of fifteen, and in the primary and grammar courses, school overwork is rare. The child will work — will pay attention — up to a certain point: but up to that age he is not sufficiently self-conscious, and he has too little ambition to make him overdo. When he reaches the limit of his endurance he stops work and pays attention to something else; he does not spur himself on to work beyond his strength. "The child remains passive; when he does not wish to work he does not work, and overwork is produced only by an effort of the will."

This rule, which has also been confirmed by Mr. Galton, holds in the majority of cases. Now and then we see a precocious child, especially a girl, who is distinctly harmed by too much study; but those cases are rare, especially in children of the out-patient class. Above the age of fifteen, however, it is another story. In hospital cases the number of children who go to school beyond that age is very small. We see, however, in private practice, especially in girls and young women, cases enough to justify the quotation at the beginning of this paper. After the age of fifteen, and during the high-school course, the conditions are altered. The period of puberty has begun, with its physical strain and its physical changes. The pupil has become more self-conscious, his ambition is aroused, the importance of preparation for the work of life begins to be appreciated, and ambition for intellectual victory over his comrades is awakened. The curriculum becomes more crowded and more absurd, and the stress of examinations greater. The youth keeps at his work, and is less ready to drop it when he begins to grow tired. Over-strain results, and, if other factors unite, break-down may follow. From obvious reasons, — a less hygienic life, limited exercise, and the development of the menstrual function, — this break-down occurs most frequently in girls. Before the period which may be roughly marked by the fifteenth year, overwork in school is much less common, and rarely occasions nervous disease.

[1] "Leçons du Mardi," i, 34, ii, 29.

XVII.

THE MOUTH BREATHER.

By Thomas Amory De Blois, M.D.

The mouth breather is not, by any means, the exclusive product of adenoid vegetation; in fact, I have found in our clinics that these growths are exceedingly rare in the adult. I have noticed this particularly while seeking clinical material for class demonstration. The patient in whose pharynx these may be seen with the mirror is a most valuable adjunct to the clinic, and is proportionately difficult to find. Some children of six or seven may be examined by the light, but prior to that age almost all explorations must be made with the touch of the finger. As the age advances, of course, rhinoscopic examination becomes easier, but it seems invariable that the easier the examination the fewer are the vegetations found, until in adult life whatever may have been adenoids have lost their existence, as such, or in a few cases have merged into the Luschka's tonsil.

Even in the cases of undoubted adenoids which come under observation, it is extremely rare to have all the air passage through the nose obstructed by them. In many cases they do not actually obstruct at all; that is, this cluster of adventitious growths does not even reach the upper border of the middle meatus (and it is very doubtful if the upper meatus is used in respiration). That the adenoid keeps up the catarrhal secretion is undoubted, particularly that which is so distressing by dropping down the pharyngeal wall.

But mouth breathing is much more common in the adult than in the child: if it were not so, many infants would starve, for the child who cannot breath at all through its nose cannot continuously nurse either the nipple or the tube of the nursing-bottle. All animals and most infants sleep

quietly with the mouth closed and breathing quietly through the nose. It is later on in life that the mouth breather increases. Now, I think it will be acknowledged by all that adenoids do not increase after infancy. What cases exist may persist instead of disappearing as the years go on, but that they either increase, or reappear after removal, I do not think can be proved.

Case I. October. Matilda B. Luschka's tonsil removed with forceps.

Case II. November. Nellie C. Pharyngeal tonsil removed with forceps.

Case III. December. Hilda J. Pharyngeal adenoids removed with forceps.

Adenoids scraped during October, November, and December, 1895, fourteen cases, of which the results were generally good.

We must look, then, for further causes of mouth breathing. Probably the two most pregnant are obstruction of the nose itself, and after that hypertrophy of the faucial tonsils.

Look a moment at the obstructions of the nose. They are necessarily of two kinds only; they may be either caused by the sides, or the septum's obstructing the lumen of the air passages. Of course the entire side of the nose, in a fracture, may be crushed in and never replaced, but usually this form of obstruction is the consequence of a large turbinated bone or a thickening of its mucous covering, this latter being principally the result of many and oft-repeated colds in the head.

There is much difference of opinion as to the causation of deflections or bends in the septum in early youth. It is obvious that the toddling infant will fall frequently, and it is equally evident that so soft a structure as the nasal septum will bend in any direction. Some of these are never straightened out. Then, too, the childish habit of introducing the finger into the nose must be responsible for some of the deformities. Mothers help this along by injudicious cleaning of the nares with the twisted-up ends of towels, matches, or even their own fingers.

I saw a case of abrasion of the septum in a very young

child, in which the mother admitted that she had caused the wound herself by cleaning out the nose with the blunt end of a hairpin. These causes would not, of course, affect the posterior parts of the turbinated bones nor of the back part of the septum which is frequently deflected also — surrounded as they are by strong bony structures, they are well protected from external injury. Unless some pressure brought upon the bony palate would cause the septum to "crumple up," as it were, it is hard to imagine what would cause these deformities. But it is to the large bulbous hypertrophies of the posterior ends of the turbinated bones that a great deal of mouth breathing is due, as well as the more important one of middle-ear diseases. There is also the spreading, and also the separation of the bony from the cartilaginous septum. Both of these are traumatic in origin, and when not treated at the time of the injury are very difficult to remedy.

The treatment of these various obstructions might be called routine; at any rate they can be classified, for in a district where mouth breathing is so common as this, the same form of operation must generally be many times repeated. It is a day of very small attendance at the City Hospital Throat Clinic when there are not from six to ten cases of hypertrophy of the turbinates. And it is usually found that the galvano-cautery point drawn once or twice along an enlarged turbinate will produce an ulceration, followed by an eschar producing sufficient contraction or buttoning down of the mucous tissue to somewhat enlarge the respiratory cavity. This procedure, occasionally repeated, will, if there is no other cause, frequently render mouth breathing unnecessary, but the mouth breather of long standing is very apt to relapse into his bad habits even then, and it is no doubt true that in these cases the nose quickly returns to its former pathological condition.

During October, November, December, 1895, there were thirty-eight cases noted of reduction of the turbinated bodies with the galvano-cautery.

The treatment where the deformed septum is the cause is not by any means so easy. Few have had the success in

breaking up and setting up the septum that has attended Dr. G. A. Leland's efforts, — and in extreme cases of deflection this is the only procedure which offers much hope of success. The saw may be used in cases where the reëntering angle on the concave aspect of the septum is not so deep as to make perforation unavoidable, if the salient angle of the other side is sawed off. Perforations of the septum are inexcusable, and are never justified by any amount of zeal in reconstructive surgery. Take it all in all, the saw is the most useful instrument for obstructions, but it is slow, and the cocaine anaesthesia does not protect the patient from the pain of more than the first superficial cut. The trephine and the Goodwillie revolving knife are excellent for spurs and short surfaces, but for a long deflection or ridge the saw should always be used. The Weir side-cutting forceps and the Rongeur forceps are useful where the turbinate and a spur on the septum are very close to each other or in apposition; in that case, both of these obstructions can be cut at the same time by a continuous or scissors movement of the instrument; but where there is a spur by itself, the Rongeur is very apt to slip off after cutting through the mucous membrane, without attacking the harder part at all. A very good procedure in this dilemma is, with a down-cutting saw, to cut the upper surface of the spur, and with an up-cutting saw to cut the under surface of it, and then with the Rongeur bite between the two cuts, and thus remove the whole spur, and also leave a good margin of mucous membrane to proliferate over the denuded surface.

Case I. Joseph R. Spur in left nostril; sawed.

Case II. Sarah J. Spur in left nostril; electric trephine (good result).

Case III. Alice S. Spur right nostril; electric trephine.

Case IV. George P. Spur and enlarged turbinate; operation by Goodwillie — revolving knife and galvano-cautery.

Case V. Charles W. C. Spur septum; revolving electric knife.

Case VI. James S. C. Spur of septum; revolving knife.

Case VII. Jerry E. McG. Spur of septum: drilled and sawed.

Case VIII. Louis D. Ridge of septum: sawed.

Case IX. Margaret T. Spur of left side septum adherent to hypertrophied turbinated body: both cut through with Rongeur forceps.

To the tonsils we must look for more cause for mouth breathing. When the mouth is left open and the buccal and pharyngeal muscles are relaxed, the enlarged tonsils drop apart and remain separated, and respiration between them may be noisy, but is easy. When the mouth is closed these same muscles are tense, and though the nares may be patent, yet nasal respiration becomes more difficult. Then, too, the separation of the tonsils into lobes, particularly when it is the upper lobe which is enlarged, will act in the way I have described above. When, however, the lower lobe is enlarged, the difference is not so apparent. Enlarged tonsils always keep up the viscid catarrhal secretion, and for this reason, also, reductive treatment is called for.

Crushing off the tonsil with the cold wire snare is practised a good deal by my colleague, Dr. J. W. Farlow, but I have found it a most painful operation without ether. But, although I have been unfortunate in breaking every écraseur that I have employed, I have succeeded in bringing away much larger pieces than I could have removed in any other way. The tonsillotome I use frequently in cases where the tonsils are so far exposed beyond the edges of the faucial pillars that the instrument can be made to act. But in all cases where the tonsils are, as it were, buried in the surrounding tissues, I use the ignipuncture, and when it is properly used it is seldom devoid of fair success. It is not always necessary to push the galvano-cautery point down to the bottom of every crypt in the tonsils. Sometimes it has seemed as if the sloughing, and consequent loss of substance, were greater when these openings were avoided. But if there appears to be a large amount of secretion, then the crypts should be cleared out and cauterized from the bottom. This little operation is almost de-

void of pain, owing to the use of cocaine, and the effects within the next few days are almost without unpleasantness. With young children, pain in swallowing will occasionally follow, but this is not to be compared with the dysphagia which follows amputation of the uvula, where the patient generally starves for about four days.

Care should be taken not to burn the pillars of the fauces, for not only owing to their being constantly in motion, are they long in healing, but the shape of the arch of the palate may be changed, which in the case of singers is a thing not to be desired. I have had many cases of young singers with enlarged tonsils, — generally sent by their music teachers, — and I have never failed to have a reduction of the tonsils praised, and the statement made that the voice had been benefited both in range and elasticity. One would naturally suppose that removing a large mass of tissue from the fauces would probably result in lowering the pitch of the voice, but this does not seem to be the case.

Case I. Delia C. Chronic enlargement of tonsils. Treated with galvanic-cautery puncture (good result).

Case II. Eloise S. Chronic enlargement of tonsils. Removed both with tonsillotome.

Case III. Carrie S. Chronic enlargement of tonsil. Removed with tonsillotome.

Case IV. Louis C. Sub-acute enlargement of both tonsils. Removed one with wire écraseur.

Case V. D. J. C. Chronic enlargement of right tonsil. Removed with écraseur and bistuary. Broke écraseur (a very tough tonsil).

Also reduced fourteen other cases of enlargement of tonsils with galvano-cautery.

The action of the teeth on respiration is certainly of the greatest importance. My colleague, Dr. Leland, has, I think, read a paper on this subject before the dental societies, but I believe that it is still unpublished.

I do not admit that the presence of adenoid growths in the vault of the pharynx is by any means as potent a factor as the teeth in the production of the high-arched palate. It has been the custom with many dentists to deprecate the

saving of the six-year molar teeth, claiming that they were useless, and would, of necessity, be lost in any case: that they were a great source of odontalgia, and by their presence while in a state of necrosis would cause the decay of other teeth. This may all be true, but it cannot be doubted that the early extraction of these, perhaps vicarious, grinders has a great effect on the formation, or, rather, the malformation, of the dental arches. If one of these teeth is extracted on one side and not on the other, the teeth on this last will rapidly move round to fill up the space left vacant, and the denture will become asymmetric. If, for instance, the upper molars are extracted, and the lower ones are retained, the incisor teeth of the lower jaw soon begin to strike first on top of and next outside of the upper incisors. Now, an "undershot" jaw, or one in this condition, is very much as if it were dislocated, and closure of the lips is difficult, not to say impossible. Under these conditions we are very apt to get a certain variety of the mouth breathers: they are not such because the nares are obstructed primarily (although all the respiratory tract may become so from disuse), but the mouth is usually partly open, and oral respiration is an easily acquired habit. Then, also, the contraction of the dental arch will produce in the upper jaw the high-arched palate, and in the lower jaw the "retreating," or weak, chin. In a typical set of teeth, the molars should rest squarely upon their fellows of the opposite set, the points of the bicuspids should interlie, the upper canine teeth should strike anterior to the lower ones, and the upper incisors lie clear and free and anterior to the lower ones. In this state, the lips remain easily closed, the tongue and mucous membrane of the cheeks is never caught between the teeth, and during rest, when not used in phonation or deglutition, the mouth becomes only a receptacle for necessary salivary secretion, and is not used as part of the respiratory tract, — to the great detriment of health, and the greater or less discomfort of one's neighbors.

XVIII.

THE USE OF THE ÉCRASEUR AND PUNCH IN THE REMOVAL OF TONSILS.

By John W. Farlow, M.D.

The opposition to operations on the tonsils on the part of patients, and the very frequent, but often erroneous, opinion expressed by physicians that "the child will outgrow the large tonsils," has much justification in the results not infrequently obtained in the attempt to rid a struggling child of hypertrophied tonsils. As Dr. W. H. Daly remarked at the last meeting of the American Laryngological Association, "There has probably been more bad surgery done on the tonsils than upon any other part of the body." I have heard many competent surgeons say that they disliked exceedingly to do tonsillotomy.

Some of the reasons for this lack of success may be:

I. Improper diagnosis, not differentiating between adenoid and tonsillar hypertrophy, and removing tonsils unnecessarily which were not the cause of trouble, and incomplete diagnosis in not recognizing the form, shape, density, relation of the tonsils to the pillars of the fauces, adhesions, and whether one or both lobes were to be taken off. This latter fault often comes from imperfect illumination of the throat and failure to use a tongue depressor properly.

II. Not depressing the base of the tongue enough so as to get the instrument around the lower and perhaps most important part of the tonsil where it presses on the tongue and fauces.

III. Insufficient assistance, so that a proper view of the parts to be operated on is not obtained, and the instrument is either not well adjusted or slips off.

IV. An unsuitable instrument, as too large a tonsillotome for a small mouth.

V. The attempt to remove all varieties of tonsils in the same way and with the same instrument, without regard to the peculiarities of the tonsil and its surroundings in the particular case.

VI. Considering tonsillotomy a simple and easy operation, and anaesthesia unnecessary.

It is essential to have good illumination, and if the patient cannot hold still it is better to use primary anaesthesia, not because the tonsil is a very sensitive organ, but on account of the fright and movements of the patient, and the anaesthesia brings about the needed relaxation. The majority of tonsils to be removed are in children, and as adenoid disease almost always coexists, it is convenient to remove faucial and pharyngeal tonsils at one sitting, if possible, and anaesthesia is a necessity, except in rare instances.

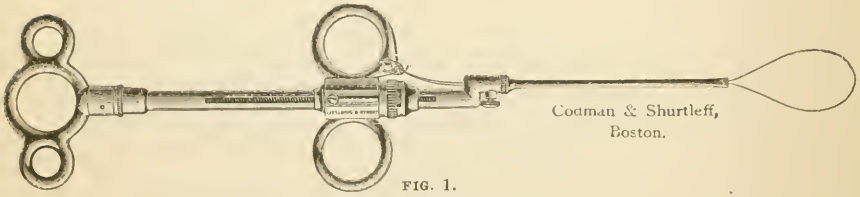


FIG. 1.

The objection to combining the two operations is the haemorrhage and shock. If the tonsils can be removed without haemorrhage, the adenoid operation can follow with safety, as a rule. I have used in a great many such cases a strong écraseur (Fig. 1), made for me by Codman & Shurtleff, which cuts through the tonsils with practically no bleeding. Steel piano wire, No. 5 (or preferably No. 7 in firm tonsils), forms the loop, which can be given any desired size or shape, and takes up no room in the mouth. This loop is pushed over the projecting tonsil and, especially its lower part, is then drawn tight, and the turning of screw movement at the end of the instrument causes the wire to be drawn through the tonsil with practically no hemorrhage, in my experience.

The throat is now clear; there is no blood to obscure the view, or choke the patient, and the adenoid can then be removed.

It is surprising to what extent the tonsils sometimes hypertrophy in the mouths of small children, where it is impossible to manipulate a guillotine large enough to encircle the tonsil, and several cuts may be necessary to remove the organ. Where the throat is already completely blocked by tonsils, the insertion into the mouth of a large guillotine makes the breathing very difficult.

In children, where the tonsils only are to be removed at one sitting, the guillotine may well be used, unless, as I have said above, the tonsils are very large, the child a bleeder, or where it is important to save every drop of

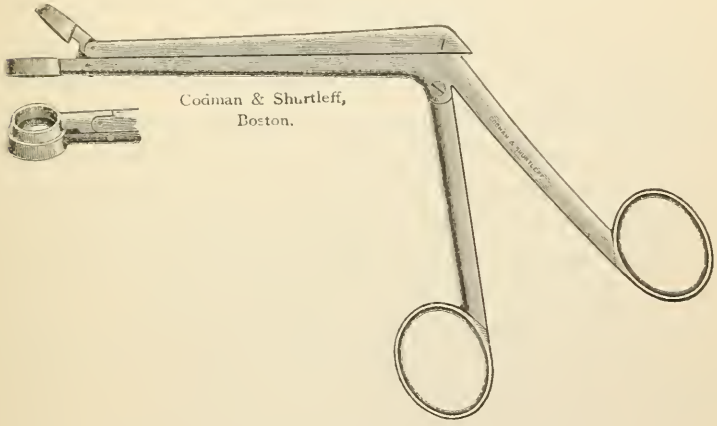


FIG. 2.

blood, in which cases the écraseur is useful, unless the tonsils do not project in such a way as to hold the loop.

Sometimes the tonsil is irregular in shape, and made up of perhaps a small upper lobe and a large lower one almost resting on the tongue, and the guillotine does not fit on well. Again, the anterior pillar may be so spread out over the tonsil as to leave only a small portion uncovered, when it is difficult to remove the tonsil with the guillotine without cutting the anterior pillar.

In such cases I have used the punch (Fig. 2), also made for me by Codman & Shurtleff, and have trimmed off the tonsil, inserting the jaws of the punch between the pillars of the fauces.

It is also useful in cutting off ragged ends and projecting portions left behind after the use of the guillotine.

At the hospital clinic I have removed a number of very large, firm tonsils in adults, in which the écraseur has worked admirably, hardly a drop of blood being lost. It is more painful than the guillotine, but seems to me a great safeguard against hemorrhage, a very important consideration.

I have also been much pleased with the use of the punch in adults in removing pieces of diseased tonsils. Such patients have usually had a number of attacks of tonsillitis, and certain portions remain in a diseased condition, which are grasped and removed by the punch. It seems to me an erroneous doctrine that all that is necessary in a given case of hypertrophied tonsils is to remove the part which projects beyond the anterior pillar. It depends upon the condition of the tonsil and also upon the situation of the anterior pillar. The object of operation is to get rid of a diseased organ, and if the guillotine does not get to the base of the diseased tissue, and if the stump that is left contains structures still subject to inflammation, they should be removed, whether they project beyond the anterior pillar or not. So that I feel that the guillotine often needs to be supplemented or replaced by something that can cut between the pillars.

This is often done with the galvano-cautery, a much slower and less satisfactory method of procedure, and one more likely to be followed by inflammation than is the punch or the discission knife.

As a result of my experience at the hospital and in private practice, I should say that tonsillotomy was often not a simple and easy matter; that plenty of assistance and good illumination were needed; that anæsthesia was often desirable and essential, and that, although the guillotine was an exceedingly valuable instrument, a strong écraseur and punch were of great value in many cases.

XIX.

THE INNERVATION OF THE SOFT PALATE.

By John Jenks Thomas, M.A., M.D.

The usual statement of text-books of anatomy, physiology, and even of special books upon nervous diseases and the anatomy of the nervous system, is that the soft palate is innervated by fibres from the facial nerve, given off near the geniculate ganglion, and passing by the great superficial petrosal and Vidian nerves to the spheno-palatine ganglion, and thence by the palatine nerves to the muscles of the soft palate. Erb, in "Ziemssen's Handbuch," makes use of this supposed fact in his scheme for locating the seat of the lesion in peripheral paralysis of the facial nerve. To specify more particularly, the usual statement is that the muscles of the pharynx are supplied chiefly by the pharyngeal branch of the vagus; the stylo-pharyngeal muscle, however, by the glosso-pharyngeal nerve; the tensor palati by a branch from the otic ganglion of the fifth nerve; while the levator palati and azygos uvulae get their nervous supply from the facial nerve by the way already mentioned. This is the statement of Quain in his ninth edition, although in the tenth edition this is questioned, and he states that it is probable that the levator palati and azygos uvulæ are supplied by the spinal accessory nerve.

Schwalbe ("Lehrbuch der Neurologie," Erlangen, 1881) gives the ordinary statement. Oppenheim ("Lehrbuch der Nervenkrankheiten," Berlin, 1894, p. 316) says that it is doubtful if the facial nerve has anything to do with the nervous supply of the palate. Van Gehuchten ("Le Système Nerveux de l'homme," Lierre, 1893, p. 354, p. 388) also questions the truth of the usual statement.

So recent a book as Sach's ("Nervous Diseases of Children," New York, 1895, p. 234) makes the usual statement,

but adds that on this point there is much doubt, and in the table of the nerve-supply of individual muscles a question-mark is placed after the seventh nerve, given as the one to these two muscles.

Gowers, on the other hand, strictly denies that the facial nerve supplies the soft palate ("Diseases of the Nervous System," Am. Ed., Philadelphia, 1893, Vol. ii, p. 307). He states that whenever disease at the surface of the medulla damages the hypoglossal and spinal accessory nerves so as to paralyze the tongue and the vocal cord on the same side, it will almost always be found that the elevation of the palate is lost. In another place (*op. cit.*, p. 236) he states that the levator palati is applied by the spinal accessory nerve, and adds that in more than a hundred cases of facial paralysis, due to disease of the nerve in various situations, carefully examined, he has never observed a corresponding paralysis of the palate. Deviation of the uvula was occasionally observed, but its inclination was as often towards as from the paralyzed side, and he says that such obliquity of the uvula is not uncommon in those who present no facial palsy, and sometimes is considerable in degree, and that when present in facial paralysis its state is unchanged after the face has recovered, and it is not associated with any defect in the movements of the palate. He also says that in cases of facial paralysis where the soft palate is involved, there is probably a simultaneous affection of the spinal accessory nerve, or of its palatine branch.

Bosworth ("Diseases of the Throat and Nose," New York, 1892, Vol. i, p. 11) gives the nerve-supply of the azygos uvulæ, levator palati, and palato-pharyngeus as from the vagus, and the tensor palati from the fifth nerve.

Cases have been reported at various times in which paralysis of the palate was associated with facial palsy, but aside from those cases in which there has been simultaneous disease of the facial and of the vago-accessory nerves, they are probably to be regarded as errors of observation. It has been quite common to consider a deviation of the uvula as a sign of paralysis or paresis of the palate. We have already seen what Gowers has said on this point. Most writers

have come to the conclusion that the position of the uvula cannot be used as a symptom of an affection of the nerve. In paralysis of the soft palate, the uvula may point either towards the paralyzed or towards the normal side. Todd ("Clin. Lectures on Paralysis," London, 1854, p. 69) mentions several cases of facial paralysis in which the uvula was not affected, in spite of the fact that the facial nerve was affected above the geniculate ganglion, as was shown by autopsy.

Benedikt ("Electrotherapie," 1868) mentions several cases of facial paralysis in which the uvula was at times inclined towards the paralyzed side, and in other cases towards the healthy side. He also mentions a case of bilateral facial paralysis in which there was deviation of the uvula.

Both Schech ("Laryngoskopische Mittheilungen," Deutsche Archiv für klin. Med., 1878, Band xxiii, Heft 1 and 2, S. 157) and Holz 1 ("Lähmung der rechten Beinerven," Inaug. Dissert, Berlin, 1877, quoted by Réthi) mention cases of paralysis in which the uvula pointed toward the paralyzed side.

Réthi ("Motilitätsneurosen des weichen Gaumens," Wien, 1893) accounts for this by two theories: First, that the azygos uvulae receives its nerve sometimes from one side and sometimes from the other, and that often the uvula, being paralyzed and hanging vertically, makes a more acute angle with the lower paralyzed side of the palate than with the healthy side, thus producing an apparent deviation towards the paralyzed side. He has also found one-half of the azygos uvulae, in normal cases, relatively much more poorly developed than the other, and with signs of degeneration, and he thinks this inequality of development may cause the uvula to hang to one side when the palate is paralyzed. He admits that the position of the uvula cannot be considered of importance even in cases of actual paralysis of the palate.

Cases of paralysis of the face, when the lesion was situated high up, with the palate intact, are not rare. Erb ("Zur Pathologie und Path. Anatomie der peripherischer Paralysen," Deutsche Arch. f. klin Med., 1868, Band iv, S.

540) reports such a case, with secretory disturbances in the nose, in which the palate was unaffected.

Benedikt (*op. cit.*, p. 277) describes two similar cases where the symptoms pointed to involvement of the facial nerve at or above the geniculate ganglion.

Gowers (*op. cit.*, Vol. ii, p. 250) quotes a case of Schultze ("Linksseitiger Facialiskrampf in Folge eines Aneurisma der Arteria vertebralis sinistra," Virchow's Archiv, Band lxv, 1875, p. 385) of aneurism of the left vertebral artery, pressing upon the facial nerve, in which there was spasm of the face, but none of the palate.

Dr. Hughlings Jackson first pointed out the frequency of associated paralysis of the larynx and palate in the London Hospital Reports (Vol. i, 1864, p. 337), and in speaking of facial paralysis says: "It is generally held by physicians that in paralysis of the facial nerve from lesion to its trunk, before giving off of the branches to Meckel's ganglion (the large superficial petrosal), there is some paralysis of the palate, but I have never seen a case of this kind of paralysis, from any cause, in which the palate was paralyzed. In cases even of paralysis of this nerve from disease of the Pons Varolii, the palate has seemed to be quite normal — real paralysis of the palate is decidedly a rare thing. If we exclude diphtheritic paralysis, it is very rare indeed."

Cases of paralysis of the palate with affection of the vago-accessory nerve, in which the face was not affected, are fairly numerous.

Seeligmüller ("Ein Fall von Lähmung der N. Accessorius Willisii," Arch. für Psychiatriet, Band iii, 1872, S. 433) reports a case of palate paralysis combined with paralysis and atrophy of the trapezius and sterno-mastoid muscles, with rapid heart and paralysis of the vocal cords. The face was normal.

Scheiber ("Ueber einige seltene Erscheinungen nach apoplektischen Anfällen im Anschluss an einen complicirten neuropathologischen Fall," Virchow's Arch., 1886, Band cvi, S. 166) reports a similar case with paralysis of the right side of the palate, uvula, pharynx, and right vocal cord. The tongue and lips were not affected.

Gottstein (" Die Krankheiten des Kehlkopfes," Leipzig u. Wien, 1890, S. 250) reports a case of left-sided paralysis of the palate and vocal cord, with atrophy of the left half of the tongue.

Avellis (Klin. Beiträge zur Halbseitigen Kehlkopfsähmung, Berliner Klinik, 1891, October Heft, quoted by Réthi) reports three cases of left-sided larynx and palate paralysis, in one of which a facial paralysis proceeded, without any affection of the palate, and as this improved and only a slight paresis remained, a paralysis of the palate and larynx on the same side came on suddenly.

S. Mackenzie (" Two Cases of Associated Paralysis of the Tongue, Soft Palate, and Vocal Cord on the same side," Trans. of the Clinical Society of London, 1886, Vol. xix, p. 317) reports two cases of unilateral paralysis of the tongue, larynx, and soft palate, together with paralysis of the sterno-mastoid and trapezius of the same side. The face was normal.

Jackson (" Paralysis of Tongue, Palate, and Vocal Cord," Lancet, April 10, 1886, p. 689) reports a similar case.

Pel (" Ein Fall von Hemiatrophie der Zunge mit linkseitiger Gaumenlähmung, Atrophie der linken M. Sterno-cleido-mastoideus und M. trapezius und linksseitiger Recurrenslähmung," Berlin. klin. Wochenschrift, 1887, No. 29, S. 521) reports a case of left-sided atrophy of the tongue, with paralysis of the soft palate, vocal cord, trapezius, and sterno-mastoid on the same side.

Erb (" Zur Casuistik der Nerven- und Muskel-krankheiten," Deutsch. Arch. für klin. Med., 1868, Band iv, S. 246) gives a case in which the left sterno-mastoid, trapezius, palate, and vocal cord were affected, while the pulse and respiration were normal.

Türck (" Klinik der Krankheiten der Kehlkopfes und der Luftröhre," 1866, S. 439) mentions still another example of the combination of palate and larynx paralysis.

Holz (*loc. cit.*) gives a case of paralysis of the right sterno-mastoid and trapezius, with rapid pulse and paralysis of the right vocal cord and the right side of the palate. The uvula deviated to the right.

This combination of paralyses also occurs in tabes dorsalis.

McBride ("A Contribution to the Study of Laryngeal Paralysis," Edin. Medical Journal, July, 1885, p. 15) reports a case of bilateral paralysis of the palate and vocal cords, accompanied by difficulty in swallowing, vomiting, and rapid pulse, in tabes.

So Oppenheim ("Neue Beiträge zur Pathologie des Tabes dorsalis," Archiv für Psychiatrie, 1888, Band xx, p. 131) describes a case in which the left side of the palate was paralyzed, and at first the right vocal cord, and later the left one also.

Aronsohn ("Zur Pathologie der Glottiserweiterung," Deutsche med. Wochenschrift, 1888, No. 27, S. 546) gives three similar cases: one of left-sided paralysis of the trapezius, sterno-mastoid, and palate: one of the right vocal cord, palate, trapezius, and sterno-mastoid; and a third of the right vagus, left abducens, and left oculo-motor, with right-sided paralysis of the palate and larynx. The sterno-mastoid, trapezius, and face were unaffected.

This combination of paralysis of the soft palate and vocal cord can be produced by pressure upon the nerve trunks outside of the cranial cavity, as is shown by several cases, thus showing that the nerves supplying these muscles lie near together in the neck.

So Turner ("On the Innervation of the Muscles of the Soft Palate," Journal of Anatomy and Physiology, Vol. xxiii, 1889, p. 523) reports a case in which there was atrophy of the right sterno-mastoid and the upper part of the right trapezius, with atrophy of the right half of the tongue, paralysis of the right vocal cord, the right side of the palate, and anaesthesia of the right half of the larynx. There was also loss of the sense of taste on the right posterior third of the tongue, and slight narrowing of the right palpebral fissure, with retraction of the eyeball and contraction of the pupil of that eye. The action of the heart was not disturbed. In this case there was a tumor of the right side of the neck which later involved the parotid gland, causing facial paralysis, and affected the hearing in the right ear. The patient died of exhaustion. No autopsy.

Fränkel ("Fall von multipler Hirnnervenlähmung," Berlin. klin. Wochenschrift, 1875, No. 3, S. 25) gives a case caused by a lympho-sarcoma in the neck, in which there was paralysis of the right side of the tongue, palate, and larynx, with anæsthesia of these parts, and a rapid pulse. The sterno-mastoid, trapezius, and face were not affected.

Israel ("Extirpation eines Cavernoms am Halse mit Läsion des N. Sympath.," Berlin. klin. Wochenschrift, 1888, No. 7, S. 120) describes an interesting case in which a tumor was removed from the neck. During the operation the sympathetic nerve and some of the cranial nerves were injured high up in the neck as they issued from the skull. The hypoglossal and accessory nerves were affected, and there was reddening of that side of the face and ear, together with myosis. Besides this there was a paralysis of the right side of the palate.

Remak ("Traumatische Sympathicus, Hypoglossus, Accessorius-paralyse," Berlin. klin. Wochenschrift, 1888, No. 7, S. 121), two months later, found signs of affection of the sympathetic, atrophy of the right half of the tongue, and the right vocal cord fixed in the position of adduction, while the palate had nearly recovered.

Réthi ("Mobilitatsneurosen des weichen Gaumens," Wien, 1893, S. 17) reports a case of right-sided paralysis of the palate, the uvula deviating to the left, with paralysis of the right vocal cord, caused by enlarged glands in the neck. The patient also had digestive disturbances. Réthi also thinks that paralysis of the palate and vocal cord may be caused by an enlarged tonsil.

A number of similar cases have been reported, with autopsy, in which the lesion was at the base, or in the medulla.

Schech (*loc. cit.*) reports a case of left-sided paralysis of the palate and vocal cord, with vomiting, where a sarcoma of the base was found, involving the left glosso-pharyngeal, vagus, accessory, and hypoglossal nerves.

M. Mackenzie ("Diseases of the Throat and Nose," quoted by Réthi) mentions a case, with difficulty in swallowing, aphonia, paresis and atrophy of the tongue, and paralysis

of the palate, pharynx, and both vocal cords. The power of elevation of the shoulders had also suffered. In this case there was also a tumor involving the glosso-pharyngeal, accessory, and hypoglossal nerves.

In Bernhard's case ("Lähmung des M. cucullaris und sterno-cleido-mastoideus dexter, sowie der rechten Zungenhälfte und des rechten Stimmbands," Deutsche Archiv für klin. Medicin, Band xxiv, 1877, S. 384) of paralysis of the right half of the tongue and palate, and of the right vocal cord, sterno-mastoid, and trapezius, there was found a tumor of the base.

Eisenlohr ("Zur Pathologie der centralen Kehlkopflähmungen, Archiv für Psychiatrie," Band xix, 1888, S. 314) describes a case of unilateral bulbar paralysis in which the left fifth nerve was affected, with anaesthesia of the paralyzed left half of the palate, paralysis and anaesthesia of the left side of the larynx, and difficulty in swallowing. The facial nerve was entirely normal. The autopsy showed an old myelitic affection of the left side of the medulla, extending from the lower end of the abducens nucleus to the first cervical nerve-root. The tubercle of Rolando, the gelatinous substance of the posterior horn, the roots of the accessory and vagus nerves, the whole of the vagus nucleus, the solitary bundle, a part of the ascending root of the fifth nerve, the inner portion of the nucleus, and the restiform body and part of the inner acustic nucleus were affected. The olive, the pyramidal tract, and the nuclei of the hypoglossal and facial nerves, and the remaining portion of the auditory nucleus, were normal.

Another case has been reported by Turner (British Medical Journal, Dec. 14, 1889, p. 1230) of paralysis of one side of the tongue, the soft palate, and larynx, which it was thought was caused by a syphilitic affection of the meninges at the base of the skull.

Perhaps the most interesting case in which a careful microscopical examination has been made is that of Turner and Bullock ("Observations upon the Central Relation of the Vago-glosso-pharyngeal, Vago-accessory and Hypoglossal Nerves, from the Study of a Case of Bulbar Paralysis,"

Brain, Winter, 1894, p. 693). The case was one of bulbar paralysis in which there was paresis of the lips, tongue, and soft palate, defect of articulation and swallowing; later on, paresis of the vocal cords and atrophy of the interosseous muscles of the hands. There was found degeneration of the cells of the hypoglossal nucleus, nucleus ambiguus, facial nucleus and of the anterior horns in the cervical and dorsal regions, with slight sclerosis of the crossed pyramidal tracts. The facial nucleus was only slightly atrophied, while the nucleus ambiguus was affected throughout and very severely. This corresponded with the clinical facts, the face having been less extensively and severely affected than the palate, larynx, and tongue. They conclude, with Kölliker ("Handbuch der Gewebelehre," 1894, S. 234) that the nucleus ambiguus is the motor nucleus of the vago-glosso-pharyngeal nerves, and that it is the motor nucleus for the elevator of the soft palate, and the tensors of the vocal cords. The lower portion of the dorsal-vago-glosso-pharyngeal nucleus was normal in this case, as in that of Tooth and Turner ("Study of a Case of Bulbar Paralysis," Brain, 1891, p. 473).

Oppenheim (*op. cit.*, S. 324) also regards the nucleus ambiguus as the motor nucleus of the vagus.

Experimental results obtained from animals and beheaded human beings vary somewhat as to the nerve-supply of the soft palate, but I have been able to find but two instances where motion was observed upon irritation of the seventh nerve within the skull. Once in five experiments on dogs, Valentin ("Lehrbuch der Physiologie des Menschen," Braunschweig, 1848, Bd. ii, S. 412) observed a slight movement of the palate. In all these experiments he found that movement took place when the vagus was irritated. Debrou ("Thèse Inaug.," 1841, quoted by Turner) also saw the palate move once only in five experiments upon the facial nerve.

On the other hand, Bastian ("Paralysis, Cerebral, Bulbar and Spinal," p. 446) mentions a case where Meckel's ganglion was removed and no paralysis of the palate followed.

Positive experimental evidence in favor of the accessory or vagus nerves is quite abundant.

Nuhn ("Versuch über den Einfluss des N. facialis auf die

Bewegungen des Gaumensegels," Heidelberg, 1849, quoted by Turner) got no results from irritation of the facial nerve in a beheaded man, but did from that of the glosso-pharyngeal, vagus, and accessory nerves.

Volkmann ("Ueber die motorischen Wirkung der Kopf- und Halsnerven," Müller's Archiv, 1840, S. 485), in animals, got negative results in the case of the facial nerve and positive in that of the vagus.

Hein ("Ueber die Nerven des Gaumensegels," Müller's Archiv, 1844, S. 297) arrived at similar results.

Réthi ("Die Nervenwurzeln der Rachen- und Gaumenmuskeln," Sitzungsberichten der k. Akademie der Wissenschaften in Wien, July, 1892), experimenting on living rabbits, dogs, cats, and monkeys, never got any movements from the irritation of the facial, but did from that of the vagus nerve, and he ("Motilitatsneurosen des weichen Gaumens, Wien, 1893, S. 30) confirmed this subsequently for the whole course of the vagus.

Reid ("Physiological, Pathological, and Anatomical Researches," Edinburgh, 1848, p. 260) got no results from irritation of the seventh nerve, but did from that of the vagus.

Stilling and Wagner (quoted by Turner) got similar results.

Bischoff (Müller's Archiv, 1843, S. clv.) saw motion of the palate produced by irritation of both the accessory and vagus nerves.

Bernard ("Leçons sur la physiologie et pathologie du Système nerveux," Paris, 1858, Vol. ii, p. 291), from experiments on the accessory at the foramen, concluded that this nerve adducted the vocal cords and the vagus abducted them.

Van Kempen ("Ueber die Function der Wurzeln des N. Vagus und Accessorius," Schmidt's Jahrbuch, Band cxx, 1863, S. 32) thinks the vocal cords are innervated from the vagus alone, and not by the motor fibres derived from the accessory nerve. After irritating the root of the vagus mechanically, in order to avoid diffuse irritation from electricity, he saw contractions in the constrictors of the

pharynx, the muscles of the larynx, and of the oesophagus, and he concludes that the accessory is a sensory nerve, except that it furnishes motor fibres to the sterno-mastoid and trapezius muscles.

Morganti ("Ueber den Nervus accessorius Willisii," Schmidt's Jahrbuch, Band xlii, 1844, S. 280) cut the fibres of the accessory nerve in rabbits, and saw no impairment of the movements of the larynx.

Navratil ("Versuche an Thieren über die Function der Kehlkopfnerven," Berliner klin. Wochenschrift, 1871, No. 33, S. 394) cut the accessory low down, before it united with the vagus, and saw no effect upon the vocal cords.

Grossmann ("Sitzungsberichten des kais." Akademie der Wissenschaften in Wien, Math-Natur. Classe, Band xcviii, Abth. 3, November, 1889) made a series of experiments upon rabbits by cutting the nerve-roots, and irritating them by electrical currents. He found that the upper roots of the vagus supplied fibres to the superior and middle laryngeal nerves, the middle bundles to the inferior laryngeal nerve, and, indeed, was able to demonstrate fibres in single roots to different laryngeal muscles. The lower bundles furnish fibres to the muscles of the neck, but sometimes the upper stem of this bundle, which is the upper bundle of roots of the accessory nerve, contains the laryngeal fibres.

Grabower (Archiv für Laryngologie und Rhinologie, 1894, Bd. ii, S. 143), from anatomical and experimental studies, concludes that the accessory nerve has nothing to do with the innervation of the larynx, but that the motor impulse to the larynx is carried by the path of the four or six lower vagus roots from the nucleus ambiguus.

Dees ("Ueber den Ursprung und central Verlauf der N. Accessorius," Allg. Zeitschrift für Psychiatrie, 1887, Band xliii, Heft 4 and 5, S. 453) cut the accessory in the middle of the neck of a rabbit, and found the nucleus ambiguus and vagus root normal, while the accessory root and nucleus were completely degenerated.

While all experiments have been unfavorable to the hypothesis of the innervation of the soft palate from the facial

nerve, they have not been uniformly in favor of the vagus nerve.

Beevor and Horsley (Proceedings of the Royal Society of London, 1886, Vol. xliv, p. 271) got contraction of the palate in monkeys by irritating the accessory nerve, and none from that of the seventh nerve.

Longet ("Rech. exper. sur les functions du nerfs, des muscles, du larynx," etc., Paris, 1841, p. 136) obtained negative results from galvanization of the vagus and positive ones from that of the accessory nerve.

Heidenhain ("Studien aus dem phys., Institute zu Breslau," 1865, II. 3) got a paralysis of all the laryngeal muscles after tearing out the accessory nerve.

Schech ("Experimentelle Untersuchung über Function der Nerven und Muskeln des Kehlkopfes," Zeitschrift für Biologie, Band ix, 1873, S. 258) concluded from experiments that motion of the vocal cords depended upon the spinal accessory nerve.

Burchard ("Verlauf des Accessorius Willisii im Vagus," Dissert, Halle, 1867, quoted by Grossmann) tore out the accessory nerve, and examined the peripheral nerves for degeneration. The pharyngeal nerve was almost completely degenerated: the superior laryngeal nerve only in part, and that in its external branch to the crico-thyroid muscle. The inferior laryngeal nerve, on the contrary, as well as the cardiac branches, were completely degenerated.

Probably these experimental results are not so much at variance as seems to be the case. This is due to a variety of causes: First, the uncertainty as to what is meant by the accessory nerve, though generally it was the internal branch of the accessory, which unites with the vagus. Then the possibility of injury of other nerves in experiments upon structures so delicate and so small as the cranial nerve-roots. And lastly, the possibility of variation in the nerve-supply in different animals, and even in different individuals of the same species. Grossmann, for example (*loc. cit.*), found in many of the rabbits used in his experiments that it was impossible to distinguish the lower vagus roots from the upper accessory roots.

In many of the experiments quoted, the effect upon the vocal cords alone was mentioned, but I have included these experiments, because it seemed to me that the clinical evidence of a common or closely related nerve-supply for the vocal cords and soft palate was so strong.

Certainly the evidence at hand warrants the conclusion that the levator palati and azygos uvulae muscles are not innervated by the facial nerve, but by the vagus, probably by fibres from the nucleus ambiguus, though possibly the fibres in the human being sometimes pass out in a separate bundle lower down, joining the so-called internal accessory branch of the spinal accessory nerve to the vagus, while this course is quite probable for many animals, at least occasionally, if not regularly.

There remains only the tensor palati muscle, which is said to be supplied by the fifth nerve, by a branch from the otic ganglion.

I can only conclude with Turner (*loc. cit.*), that since no cases are recorded where the fifth nerve was diseased, and this muscle paralyzed, the evidence seems insufficient for assigning to it a different nerve-supply from that of the other muscles we have been considering.

Gowers (*op. cit.*, Vol. ii, p. 218) takes the same view, and Reid and Longet (quoted by Turner) saw no effect upon this muscle from irritation of the fifth nerve.

I will add here a report of a case of paralysis of the vocal cord and soft palate. Mrs. McC., aged 35, was seen by me on Oct. 14, 1893, having been referred by Dr. Hunting, of Quincy. Family history: Her father and mother were both living and in good health. Five brothers and four sisters were living, and all healthy, with the exception of one brother, who suffered from dyspepsia. One brother had died at the age of nineteen. His death was said to have been caused by vaccination.

The patient had had two children, both of whom had died. The first was born in August, 1890, and lived ten days. It had some cerebral trouble, and was comatose for four days preceding death. The second child was born in September, 1891, and died of tuberculosis of the lungs

at the age of fourteen months. There had been no miscarriages.

The patient had had chicken-pox and measles when a child, and typhoid fever at seventeen. She never had any other illness, except that some years before she had been "run down." She had been a domestic before marriage, and had been married four years. Her husband is healthy. No history of any symptoms pointing to syphilis could be obtained. The patient lived in a new house, but one where they got but little sun. She had had no sore throat.

Present trouble: About the first week in September, that is, about six weeks before she was seen, she began to have trouble in swallowing, and liquids regurgitated through the nose. For about a month before the trouble began she had been troubled by indigestion, which occasionally amounted to pain, but which had little connection with the ingestion of food. She had been somewhat troubled for the previous month with dizzy headaches. For three years the bowels had had a tendency to looseness, the patient having from two to six movements a day. The appetite had been rather poor. The trouble in swallowing became worse, and about three days after the onset she became hoarse. Up to the first of October, that is, for about three weeks, there had been no change in the symptoms. Since then she thought there had been some improvement. Fluids did not come through the nose so much as previously, but she could swallow solids only without difficulty. She was hoarse, and could not speak above a whisper, and she complained that the effort of speaking seemed to cause headache. For the previous ten days she had had a cough.

Physical examination: The patient was of good size and development, slightly anaemic and rather poorly nourished. The chest was a little flat. The thoracic wall was slightly more prominent at the second and third costal cartilages to the right of the sternum than on the left. Percussion over this area was normal. The area of cardiac dulness was not enlarged. It began at the third rib on the left, and extended downward to the fifth left interspace. To the left it extended to within 1.5 cm. of the nipple line, and to the right to the

middle of the sternum. The apex beat was visible 2 cm. inside the nipple line in the fifth intercostal space. There was a soft systolic murmur with the first sound over the second left interspace. The second pulmonic sound was not accentuated. The heart sounds were otherwise normal, and no abnormal sounds were heard elsewhere. The area of dulness over the great vessels at the upper part of the sternum was slightly increased in breadth, and extended to the right border of the sternum, at the second interspace. The second aortic sound could be heard over the vessels in the neck. There was no venous hum in the neck. There was a slight pulsation visible in the neck, systolic in time, and evidently transmitted from the large arteries. The carotid pulse on the two sides of the neck was equal in size and in force, and quite synchronous. The same was true of the pulse in the radial arteries. There was no dilatation of the superficial veins in the neck, nor over the chest wall. There were no enlarged glands to be felt in the neck or axilla. The pulse was normal in rate (seventy-two) and regular. The examination of the chest was negative. The gait was normal, and there was no dizziness nor swaying. Romberg's symptom was absent. The voice was hoarse, and she spoke only in a whisper, but speech was not otherwise abnormal. No tremor of the hands or tongue. No incoördination. There was a slight discoloration of the gums near the teeth in places. Sight, hearing, and smell were normal. The pupils were equal, and reacted to light and with accommodation. The external ocular muscles were normal. Sensation in the face was normal, as, indeed, it was elsewhere over the body. There was no affection of the muscles of mastication. There was no facial paralysis or paresis. Taste was normal. The tongue was protruded normally, and it was not atropied. The sterno-clydo-mastoid and trapezius muscles were not paralyzed nor atrophied. There was no paresis of the extremities. The reflexes were normal, the knee jerks being lively and equal. There was complete paralysis of the left side of the soft palate, which hung lower than the right side. On phonation the uvula was drawn up and to the right. The uvula was not

deviated. On laryngoscopic examination the left vocal cord was seen to be immovable, in the cadaveric position. The right cord, on phonation, moved to and beyond the median line, and moved normally on respiration.

The further history of the case I can only give in a general way. The paralysis remained the same for some time, and then improved somewhat, but some paralysis always remained. In December, 1893, the patient was very ill with pleurisy and pneumonia, and later developed tuberculosis of the lungs. She died of this on June 6, 1895. An autopsy was not obtained. I wish here to thank Dr. Hunting for information in regard to the case.

In this case there was probably pressure upon the nerve to the palate and vocal cord, either within the skull or high up in the neck. Against the seat of the lesion being in the neck was the fact that no enlarged glands or new growth was felt there. In view of the outcome of the case, we should suspect the pressure to have been produced by a tubercular deposit or gland.

The second case I wish to report is not so clear a one for the purpose of this paper, since other nerves than that to the soft palate and vocal cord were involved. But in this case, the paralysis of these parts seemed to me to be of higher degree than that observed elsewhere. This case was seen at the Boston City Hospital, upon the service of Dr. Bullard, to whom I am indebted for permission to report the case.

John McC., aged 24 years, married, porter, born in Ireland, came to the hospital on Sept. 20, 1895. He had just recovered from typhoid fever. No alcoholic or syphilitic history could be obtained. At the first pregnancy his wife had borne triplets, two of which died at once; the other is living and healthy, as is the child born at the second pregnancy. On August 2 he had an abscess on the right cheek over the malar bone which was incised, and he thought the bandage about the throat was very tight. About a week after this he was attacked suddenly by hoarseness, though at first he placed the date of the commencement of this about the first of September. This hoarseness increased

gradually, and in three days he was unable to speak except in a hoarse whisper. He had had no cough nor sore throat. He vomited once recently, and this was accompanied by pain in the abdomen. He had had occasional headaches, but these had not been severe. Slight dizziness.

Physical examination: The patient was fairly developed and nourished. Gait normal. Slight unsteadiness on turning, and a tendency to lean towards the right when standing with the eyes closed, but no swaying. Pupils reacted normally to light and with accommodation.

Dr. Bossidy reported the fundus of the eyes as normal. The external ocular muscles were normal. Smell was normal. No regurgitation of liquids through the nose, and no difficulty in swallowing noticed.

Sensation in the face and elsewhere normal to touch and for pain and temperature. The muscles of mastication were normal.

There was moderate paresis of all the branches of the right facial nerve. The right eye could not be completely closed. Hearing was much diminished on the right. Dr. Leland gave the following report:

R. Ear.	b.	b.	b.	b.	=
	c	c^1	c^2	c^3	c^4
B =	7″	3″	7″	5″	6″
A =	0	0	3″	5″	4″
Galton's pipes.			R.	3.2	
			L.	4.5	

W. L.

The right shoulder is lower than the left, and is raised less well. The right arm is elevated to the perpendicular less easily than the left. The right trapezius and sterno-cleido-mastoid are weak and somewhat atrophied.

Dr. Leland reports the laryngoscopic examination of the throat as follows: The right pyriform fossa is less deep than the left. The right interior half of the larynx is covered with mucous, the left half clean. The right vocal cord is in the cadaveric position, and the left cord alone moves.

Upon grasping with the right hand, the hand deviates to

the ulnar side, but no isolated paresis of the muscles of the extremity can be made out. The dynamometer gave right hand 30, left hand 60. The strength of the lower extremities was equal.

The knee-jerk was diminished on the right and normal on the left. The cremasteric, epigastric, and abdominal reflexes were normal and equal.

The tongue deviated slightly to the left. No atrophy of the tongue. The taste was normal.

The paretic muscles of the face, and the trapezius and sterno-mastoid muscles, showed diminished excitability to the faradic current, and also diminished excitability to the galvanic current, with no change in the formula nor in the character of the contraction.

The right side of the soft palate hung lower than the left, and the uvula was drawn to the left on phonation. The sensation of the soft palate was normal. The pulse was 100 and regular.

In this case we evidently have to do with a process injuring the seventh, eight, tenth, and eleventh nerves within the cranial cavity, or at their nuclei.

XX.

THE TREATMENT OF TYPHOID FEVER WITH TYPHOID THYMUS EXTRACT.[1]

By George B. Henshaw, M.D.

Within the last few years, more than fifteen hundred remedies have been suggested for the treatment and cure of typhoid fever. All sorts and kinds of foods have been advocated as of especial value in the diet; hydrotherapy and antipyretics have been advised for the reduction of the fever; attention has been called to the value of intestinal antisepsis; while the special symptoms arising during the course of the disease have been relieved, experimentally, at least, by almost every resource of the pharmacopoeia. These methods, however, have not proved invariably efficient in modifying the course or severity of the disease.

While the researches of certain bacteriologists which have led to the undoubted success of antitoxin in the treatment of diphtheria have been going on, other investigators have been laboring to apply the same principle to other specific infectious diseases. Tuberculin and a streptococcus antitoxin are already on the market. Why not, then, a typhoid antitoxin? As it directly leads up to the subject of this paper, let us briefly review the work that has been done along this line.

The bacillus discovered independently by Koch and Eberth (1881), and carefully studied by Gaffky (1884), is now generally recognized as the specific cause of typhoid fever. It is constantly found in the form of small scattered colonies in the spleen, the liver, the glands of the mesentery, and the diseased intestinal glands in fatal cases of typhoid fever, and may be obtained by puncture from the spleen during life. It may also be isolated from the stools of patients

[1] A Paper to which was awarded the Lyman Prize for the year 1895.

during the active stage of the disease. The typhoid bacillus closely resembles the common bacillus found in the intestines of healthy individuals, the "bacillus coli communis" discovered by Escherich. But it can be differentiated from this by certain biological tests, and is considered as a distinct species. Both the typhoid bacillus and the "colon bacillus," however, vary considerably, "as a result of conditions relating to their environment."

Brieger (1885) found in cultures of the typhoid bacillus small amounts of volatile fat acids, and where grape sugar has been added to the culture medium, lactic acid. He also obtained a highly alkaline basic substance possessing toxic properties, which he named typho-toxin ($C_7 H_{17} NO_2$). This he supposed to be the specific product to which the pathogenic action of the bacillus is due. It produced in mice and guinea pigs salivation, paralysis, dilated pupils, diarrhœa, and death.

More recent experiments by Pfeiffer (1894) led him to conclude that the specific poison of the typhoid bacillus is not present in filtered cultures, but it closely associated with the bacterial cells. According to Pfeiffer, the bacillus may be killed by a temperature of 54 degrees C. without injury to this toxic substance. The fatal dose of the dead bacilli is from three to four milligrammes per hundred grammes of body weight for guinea pigs. He claimed that susceptible animals could be immunized by means of this toxic substance, and their blood found to contain an antitoxin which had a specific bactericidal action on the typhoid bacillus. He also demonstrated the presence of a typhoid antitoxin in the blood serum of individuals who have recently suffered an attack of typhoid fever. Similar conclusions were drawn by Chantemesse and Widal, Bitter, Bruschettini, and Stern, from elaborate experiments on mice and guinea pigs, conducted in their laboratories. Unfortunately the immunity created in all the animals experimented upon has only been of very short duration. Moreover, in cases of typhoid fever which have been treated with considerable doses of serum from immunized animals, the progress of the disease has not been altered. In a

short series of experiments on guinea pigs and white mice which I have been conducting during the last three months at the Harvard Medical School, I have been unable to produce any appreciable immunity, or secure an antitoxin which would give any satisfactory reaction.

In October, 1893, Eugene Fraenkel reported to a medical association in Hamburg his treatment of fifty-seven (57) cases of typhoid fever by the deep injections of thymus bouillon in which the typhoid bacillus had been grown and then killed. He had followed the work of Brieger, Pfeiffer, Chantemesse, Widal, Bitter, Stern, Orlandi, and others, and believed that a shorter method than the production of an animal antitoxin could be used to accomplish the desired result. The use of a bouillon made from the thymus glands of calves as a culture medium was probably chosen for two reasons: First, it was found to be a favorable medium for the rapid growth of the typhoid bacilli, and one in which a particularly virulent form would undergo only very slight, if any, change; and second, from a theory on which the use of thymus glands in the treatment of certain other diseases was founded, through the promotion of leucocytosis, or possibly, phagocytosis. It has been claimed that injections of an extract of the thymus glands of calves favor a separation of the "alexines" (defensive proteids possessing peculiar germicidal properties) from the leucocytes. These "alexines," according to Buchner, are derived from the eosinophile granules of the eosinophile leucocytes. Thus the germicidal power of the blood serum is said to be increased when the number of leucocytes is considerably augmented. That the examination of the blood during the active stages of typhoid fever commonly reveals a marked leucocytosis is suggestive in this connection. So thymus extract plus the toxic products of typhoid bacilli should be an excellent substitute for an antitoxic serum. The preparation of such an extract is certainly simpler, surer, and more expeditious than an animal antitoxin could be. The method of preparation of this typhoid thymus extract, so called, as used by Fraenkel, Wooldridge, Brieger, Kitasato, and others, and the one which I tried in my experiments, is as follows:

Thymus glands of calves, obtained as soon after the death of the animals as possible, are chopped very fine and mixed with distilled water, using for every gramme of the chopped glands two cubic centimetres (2 c.c.) of water. This mixture is allowed to stand in the ice-box to digest for eighteen (18) hours. It is then strained through cheese-cloth, and squeezed out as thoroughly as possible. This gives a cloudy, mucilaginous fluid, which is alkalinized with potassic hydroxide (K O H) until not quite neutral to the phenolphthalein test, but distinctly alkaline to litmus. The fluid is then further diluted one-third with water, and sterilized one-half hour in steam at 100 degrees C. This changes the color to a grayish brown. It is then filtered until the resultant fluid is of milky white opalescence. Fifty cubic centimetres (50 c.c.) of this fluid is pipetted into a small, previously sterilized Ehrlenmeyer flask. This is sterilized in steam at 100 degrees C. for two successive days, then the culture medium is ready for use. The extract is inoculated from a broth culture of the pure typhoid bacillus (Eberth's), obtained fresh from the spleen of a patient dead of typhoid fever. It is then placed in a thermostat at 37.5 degrees C., and allowed to develop for seventy-two hours (3 days). A perceptible sediment at the bottom of the flask shows a well concentrated culture medium containing the typhoid toxin, as the sediment is largely made up of the disintegrated bodies of dead typhoid bacilli. The flask is then sterilized by heating in a water bath at 63 degrees C. for one-half hour. This kills the typhoid bacilli without injury to the toxic product. The extract is then tested on agar-agar plates, and, if sterile, is ready for administration. I have been unable to find any record of or to determine as yet the exact strength of this toxic product, so that, for the present, this must remain empirical. Eight cubic centimetres, which is the largest dose I have given at one time to a typhoid patient, did not produce any noticeable toxic symptoms in a full-grown guinea pig (weight, nine hundred and twenty grammes).

Two obstacles to the preparation of this extract: It is obvious that the more virulent the typhoid bacilli are, the

greater will be the toxic value of the desired product. The typhoid organisms soon deteriorate by successive inoculations on artificial media. Hence fresh cultures from the spleen of a patient dead of typhoid fever are to be preferred. But these are very rarely to be obtained at the moment they are wanted, and this fact proved a great hinderance to me in my work.[1] Another obstacle to the use of this extract is the fact that it cannot be kept long after it is made. When preserved in Ehrlenmeyer flasks, or in the ordinary 20 c.c. bottles, and stoppered with cotton and a rubber cap, at the end of two or three weeks it shows marked signs of decomposition, and would appear unsafe for use. The cause of this change, which is probably chemical in nature, is not known. This necessitates the making up of fresh extract for almost every case to be treated. To overcome this objection I am at present trying to determine how long the extract may be preserved intact by several expedients. The simplest one and that promising the best success is by enclosing the fresh product in hermetically sealed tubes, and keeping these at a constant, low temperature in a dark compartment. Sufficient time has not as yet elapsed for me to report conclusively on this method at this time.

To secure favorable results with the typhoid thymus extract, the cases must be treated in the early stages of the disease, within the first ten to fifteen days after the initial symptoms have manifested themselves. The extract is administered by deep injection, usually into the gluteal region or in the thigh, alternating from side to side with each dose. For this purpose I preferred to use a Koch's

[1] Elsner has recently reported his success in obtaining a pure culture of typhoid bacilli from the stools of typhoid patients by using potato gelatin made up with one per cent. of iodide of potash as a culture medium. The iodide restrains the growth of all organisms save the typhoid bacillus and the coli communis. These can be separated by appropriate methods and tests. I tried a flask of typhoid thymus extract made from fresh cultures from typhoid stools on one case, but the virulence of the typhoid organisms seemed to be diminished, as shown by the lessened reaction to the injections. From stools passed early in the course of the disease, when the organisms present are supposed to be more virulent, it may be possible to secure a culture of the desired strength. A final method for the determination of the virulence of the typhoid bacillus has yet to be discovered. The statements made by several German investigators that they have succeeded in doing this has not been verified by experience.

tuberculin syringe. The needle is of the ordinary hypodermic size, and the cylinder is measured off into cubic centimetres. For the first dose I have given usually one cubic centimetre. The injections are repeated every twenty-four (24) hours, and the dose is increased one cubic centimetre each day until five or even eight cubic centimetres are injected at a time, or the desired reaction has occurred. After the second or third injection, Fraenkel reported a slight rise in temperature with or without chill, and on the third or fourth day "a decided fall in temperature, not to be accounted for by the usual course of the disease;" and on the following day a fall still more marked. The pulse came down to normal with the temperature. The typhoid stools (typical — light-colored, pea-soup) disappeared, perspiration and diuresis were copious, and the whole condition of the patient showed marked improvement. No untoward symptoms appeared referable to the heart's action, lungs, or kidneys. If the temperature rose again, under a continuance of the injections in increasing dosage, the patient in from five to eight days would be apyretic. Even when the fall of temperature was not complete, the fever changed from the continuous to the remittent type. Still more marked was the change in the general condition of the patient under the influence of the injections. The somnolence, stupor, and delirium disappeared: sleep became natural; the coated tongue cleared: the patient began to feel hungry: the stools became normal, and the meteorism improved. The diazo reaction in the urine, supposed by some to be due to the elimination of the toxic products of the disease, was said to disappear after the second or third injection. This did not prove to be affected in the cases where I could make observations. This treatment did not prevent complications or relapses, but when the latter did occur, they quickly yielded to further injections. Fraenkel claimed that he did not select his cases for this treatment, but believed it to be effective in the severe as well as the mild forms of typhoid fever. His results in the fifty-seven cases treated were most favorable.

Dr. A. Lambert, of New York, in the spring of 1895,

reported twenty-eight cases of typhoid fever treated by him with typhoid thymus injections at the Bellevue Hospital. Of these, "fifteen (15) showed more or less marked improvement fairly attributed to the injections. Twelve did not improve, and one death occurred." In the twelve cases showing no benefit he began his injections too late — from the tenth to the twenty-second day of the disease. The fatal case was also tried as a last resort, but death occurred from intestinal haemorrhages. In two cases he recorded a local reaction — redness and tenderness at the point of injection and extending for an inch or two into the neighboring tissues. This subsided in one or two days. He states that this treatment certainly modified the severity and in several cases shortened the duration of the disease, and is positive that no harmful results ensued from the injections. One case, which in the second week of the disease had a temperature ranging from 104 degrees to 105 degrees, after five injections was apyretic, and the temperature remained normal, and the patient was up and about, practically well, by the beginning of the fourth week.

Perhaps the most marked advantage to be gained by this method of treatment is the entire omission of the classical third week of the fever, called by some "the sloughing period." Instead of this much-dreaded stage, patients who have been injected early should be convalescent.

Through the favor of Dr. A. L. Mason, I began this method of treatment on a few typhoid fever patients at the Boston City Hospital early in October last (1895). The cases were not especially selected, but only those patients were injected who entered the hospital early in the disease, before the fifteenth day, if possible. Since that time I have treated thirteen patients with the injections of typhoid thymus extract (prepared by the method previously rehearsed). Notes on these cases will follow.

Previously, cases A, B, and C are mentioned for comparison. These three cases are cited to illustrate the not unusual course of typhoid when not treated by any injections. The routine treatment of typhoid fever at the Boston City Hospital has been the giving of sponge baths, water at

70 degrees F., every four hours if the temperature of the patient is 102.5 degrees or over: stimulation according to the indications of the pulse, and strictly milk for nourishment during the active stage of the fever. Attention is called to what may be considered the average range of the fever: about 102 degrees for thirty-two days in cases A and B, when the temperature falls by lysis, not remaining normal until sometime during the seventh week.

In case C the temperature ranged higher, and continued about 102 degrees until the forty-third day. All charts were omitted after the normal temperature was established.

These cases were perfectly typical in every way, so that a positive diagnosis could be undoubted. Case C showed a tendency to relapse during the fifth and sixth weeks. He was very low during the thirty-ninth and fortieth days. These cases made perfectly good recoveries, as indeed most of the typhoid patients at the hospital have, whatever the treatment, during the last six months.

CASES TREATED BY INJECTION OF TYPHOID THYMUS EXTRACT.

Case I. A. E. L., 31, M., colored.

Present Illness. — Began, ten days before entrance, to have diarrhœa, severe backache, and stiff neck. Epistaxis. Constipated.

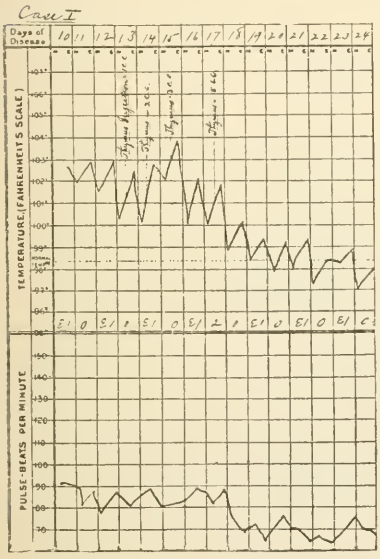
Physical Examination. — Tongue shows thick, dirty white coat. Abdomen: distended, tympanitic, not tender. Many rose spots. Spleen never enlarged to percussion.

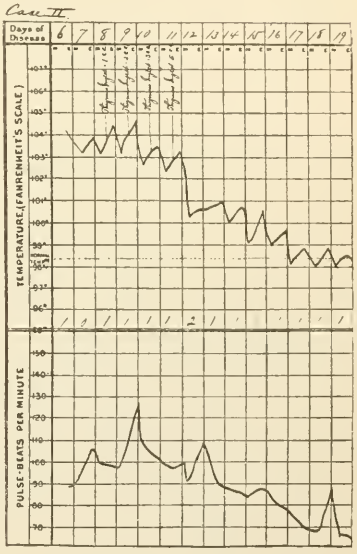
Four days after entrance, on thirteenth day of disease, injected with 1 c.c. typhoid thymus extract. Complained of some pain at site of injection for two hours following.

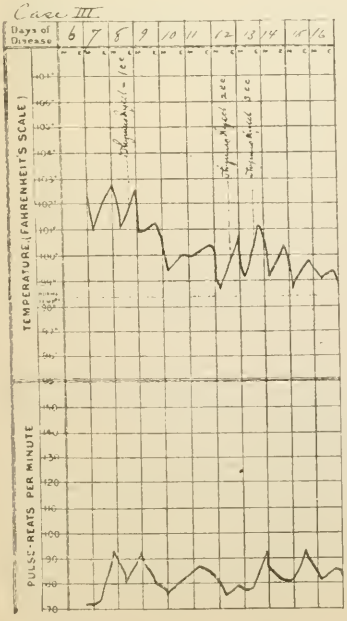
Fourteenth day: injected 2 c.c. No change. Fifteenth day: injected 3 c.c. Followed in P.M. by unusual rise in temperature and considerable perspiration. Sixteenth day: temperature dropped, and appearance of patient improved. Seventeenth day: injected 5 c.c. Followed by some redness and tenderness at point of injection, right thigh. He appears brighter. Nineteenth day: temperature normal.

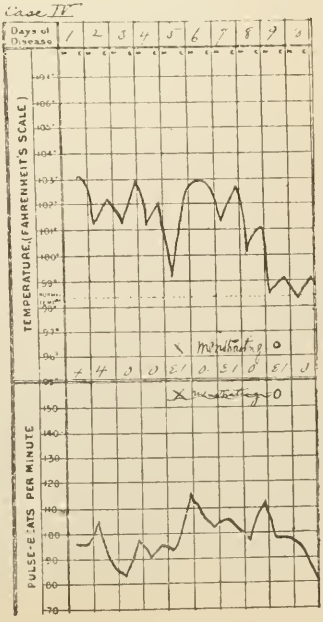
Patient bright and looking well. Twenty-ninth day: sits up in chair and blankets. Thirty-fourth day: discharged from hospital well.

Case II. H. R. D., 20 years, S.









Present Illness. — Six days before entrance anorexia and general malaise. No chill. Has been delirious.

Physical Examination. — Slight general abdominal tenderness. Ten rose spots present.

Eighth day: injected 1 c.c. Considerable discomfort followed. Ninth day: injected 2 c.c. Tenth day: injected 3 c.c. Eleventh day: injected 5 c.c. Slight tenderness present. Twelfth day: temperature falls by crisis. No chill. Seventeenth day: temperature normal. No delirium since first injection. He appears bright, and is rapidly improving in general condition. Thirtieth day: sitting up out of bed. Thirty-ninth day: discharged well.

At entrance this case bid fair to be quite a sick man, and have a protracted fever. Baths were omitted as unnecessary on the twelfth day.

Case III. N. D., Male.

Present Illness. — Six days before entrance, anorexia, epistaxis, and chills. Had to give up work and go to bed.

Physical Examination. — Face flushed. Lethargic. Abdomen: gurgling, few rose spots presents. Spleen: enlarged, edge felt.

Eighth day: injected 1 c.c. Some pain and headache in P.M. Twelfth day: although case is only mildly sick there is a tendency to resumption of fever. Injected 2 c.c. Thirteenth day: injected 3 c.c. After fourteenth day, temperature never above 100 degrees.

Case is complicated with gonorrhœa, which prolonged convalescence. He steadily improved, however, and was up on the thirteenth day. Forty-fifth day: discharged well.

This case would probably have done as well without the injections, so that no claim can be made in favor of this treatment. .

Case IV. S. U., Female.

Present Illness. — Anorexia and severe headache for five days. Nausea. No chill or epistaxis.

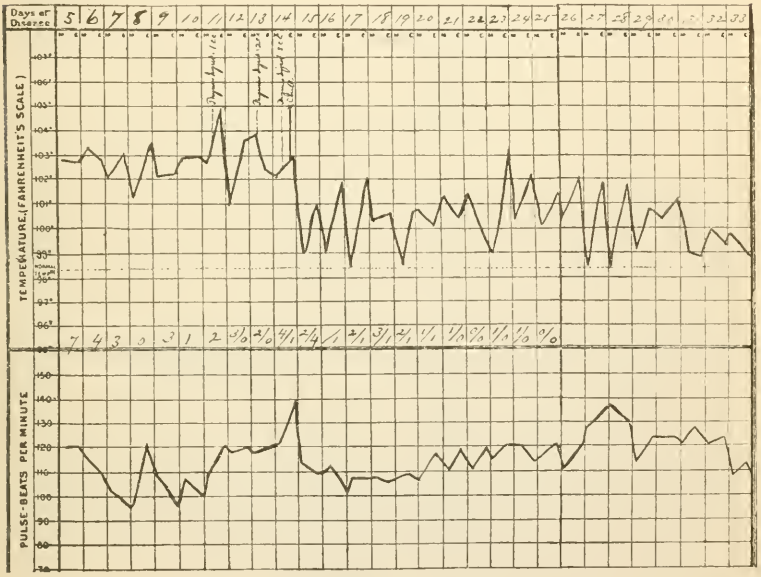
Physical examination shows spleen enlarged to percussion, and edge felt. Abdomen: slight tenderness, no rose spots.

Fifth day: marked fall of temperature, due possibly to sponge-bath. Ninth day: temperature has fallen by crisis

to normal. Marked general improvement. Eighteenth day: has bed rest, convalescing steadily. Thirtieth day: discharged well.

This was a mild case in the female Ward R, and did well without any injections. The fall by crisis is quite unusual. Cited for comparison.

Case V. M. E. B., 25, married, female.

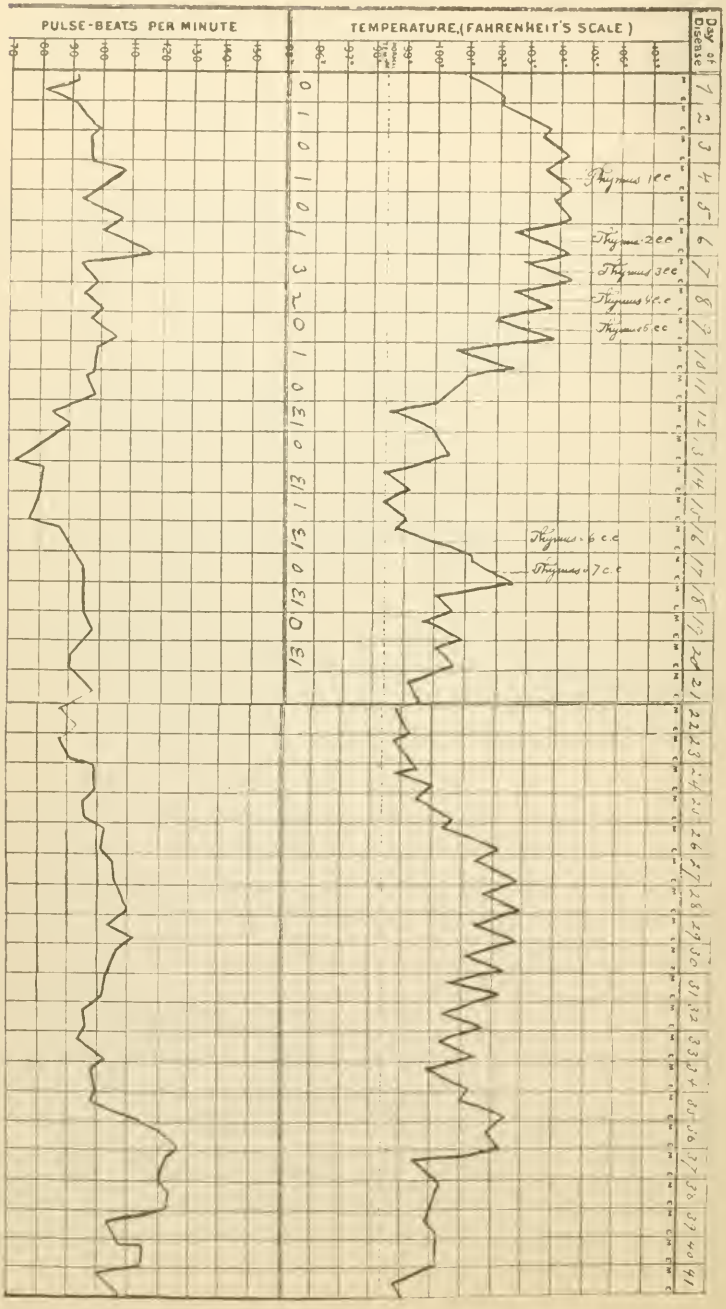


Present illness. Four days before entrance had headache and general malaise. Anorexia and pallor. Diarrhoea.

Physical Examination. — Typhoidal look. Anaemic. Has chronic hip-disease. Abdomen shows few rose spots. Spleen enlarged.

Eleventh day: injected 1 c.c. Temperature rose to 105 degrees in P.M. Complained of considerable pain and tenderness at point of injection. Thirteenth day: injected 2 c.c. She complained considerably of pain and distress. Fourteenth day: injected 3 c.c. Followed in P.M. by severe chills. Fifteenth day: temperature dropped in A.M. to 99 degrees. She looks and feels much better. Sixteenth and seventeenth days: would have given injections, but patient refused treatment.

From this time on the temperature ran an irregular course, generally lower, however, than at any previous time.



She steadily improved in spite of her temperature indications, and by the thirtieth day felt quite well.

Fiftieth day: sat up out of bed. Convalescence longer, owing to chronic hip-disease present. Sixtieth day: discharged well.

Case VI. P. G., 28 years, single, male.

Present Illness. — Stopped work the day before. Anorexia and general malaise.

Physical Examination. — Face flushed. Dull. Spleen enlarged to percussion. No rose spots.

Fourth day: injected 1 c.c. Temperature 104 degrees. Sixth day: injected 2 c.c. No reaction. Seventh day: injected 3 c.c. Eight day: injected 4 c.c. Ninth day: injected 5 c.c. Twelfth day: temperature fell by crisis to normal. He appears much brighter and says he is hungry. Sixteenth day: temperature rising to 101 degrees. Injected 6 c.c. Seventeenth day: temperature rising to 102.5 degrees. Injected 7 c.c. Eighteenth day: a drop to 100 degrees. Patient feels better. He continued about the same for a week, when there was a resumption of fever temperature. Unfortunately, I was unable to resume injections at that time, and the disease continued to run its own course until convalescence was fairly established by the forty-second day. He was entirely well by the sixtieth day.

Case VII. M. L. C., male.

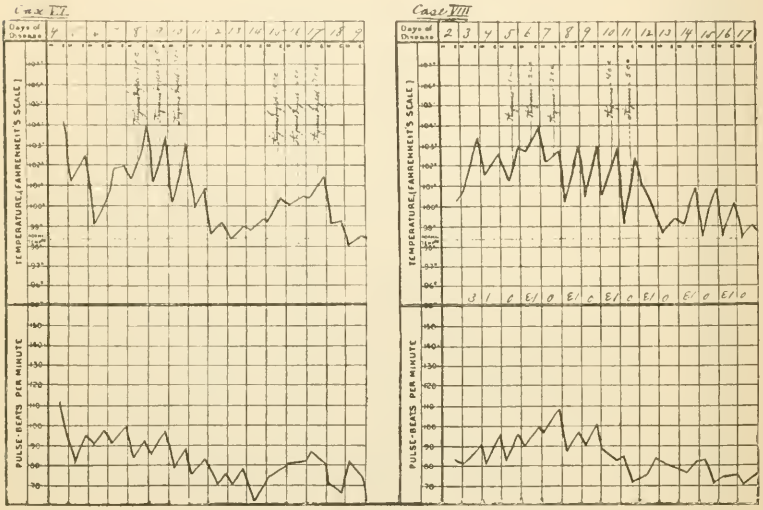
Present Illness. — Taken sick three days before entrance. Symptoms typical. Enlarged spleen, and rose spots present. Face flushed.

Eighth day: injected 1 c.c. Ninth day: injected 2 c.c. Tenth day: injected 3 c.c. This was followed in P.M. by nausea and vomiting, headache, and perspiration profuse. Twelfth day: temperature normal. Tongue clean. Fifteenth day: tendency toward more fever, so injected 5 c.c. Sixteenth day: injected 6 c.c. Seventeenth day: injected 7 c.c. No reaction. Complains of hunger. Nineteenth day: temperature normal. Appears bright. Convalescence slow but steady. Thirteenth day: discharged well. He had been much sicker than the chart would show.

This is a case where I feel confident that the injections

were of undoubted value. The case was a mild one, and he would probably have done well without any treatment whatsoever, but the rapid fall of temperature (by crisis) and the rapid improvement in the general appearance of the patient can be attributed fairly to the use of the extract. The patient himself believed this strongly — that his improvement began with my treatment.

Case VIII. C. B., 26 years, single, wardmaster.



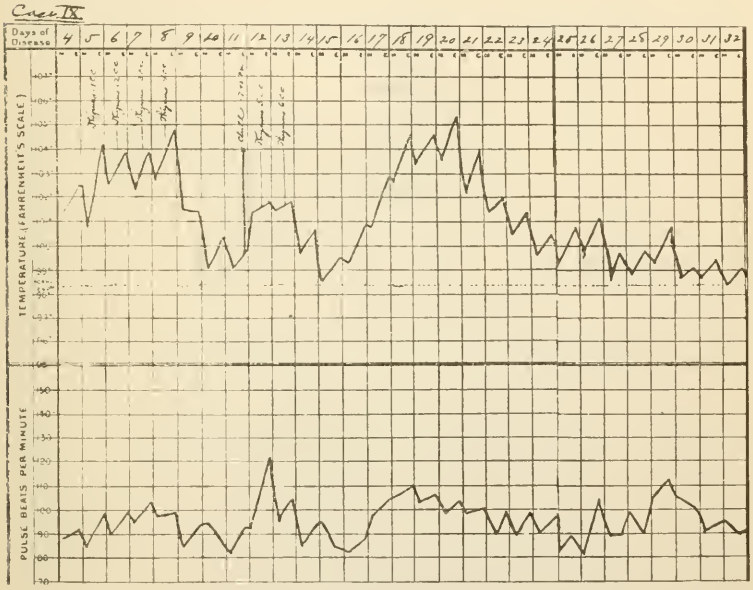
Present Illness. — Worked up to day before entrance as patient. General malaise, chilly sensations. No epistaxis. Bowels constipated.

Fifth day: general appearance typical of typhoid. Rose spots and enlarged spleen present. Injected 1 c.c. Sixth day: injected 2 c.c. Seventh day: injected 3 c.c. No marked reaction. Tenth day: injected 4 c.c. Slight general improvement. Eleventh day: injected 5 c.c. Appears much brighter. Thirteenth day: temperature almost normal. He has begun to feel hungry. Fourteenth to sixteenth: slight resumption in evening temperature, but general condition is excellent. Twenty-second day: sat up. Thirtieth day: discharged well.

This case also showed marked improvement as the result of the injections. The patient himself felt that he had been

much helped by the treatment. He felt much better after the injections were given, and thought he became well quicker.

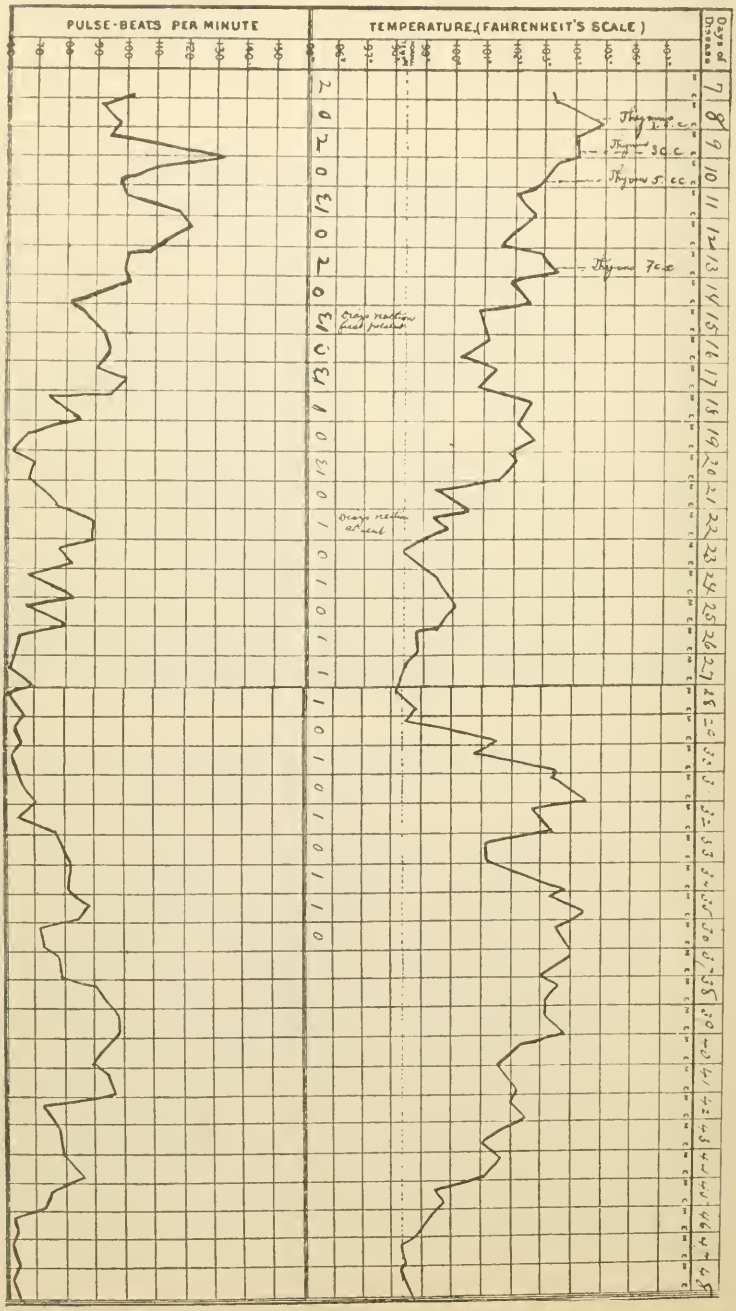
Case IX. T. G., brother to Case VI., 24 years, single. He entered on the fourth day of his disease, with well-marked symptoms.


Case IX.
Days of Disease
4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
TEMPERATURE (FAHRENHEIT'S SCALE)
PULSE BEATS PER MINUTE

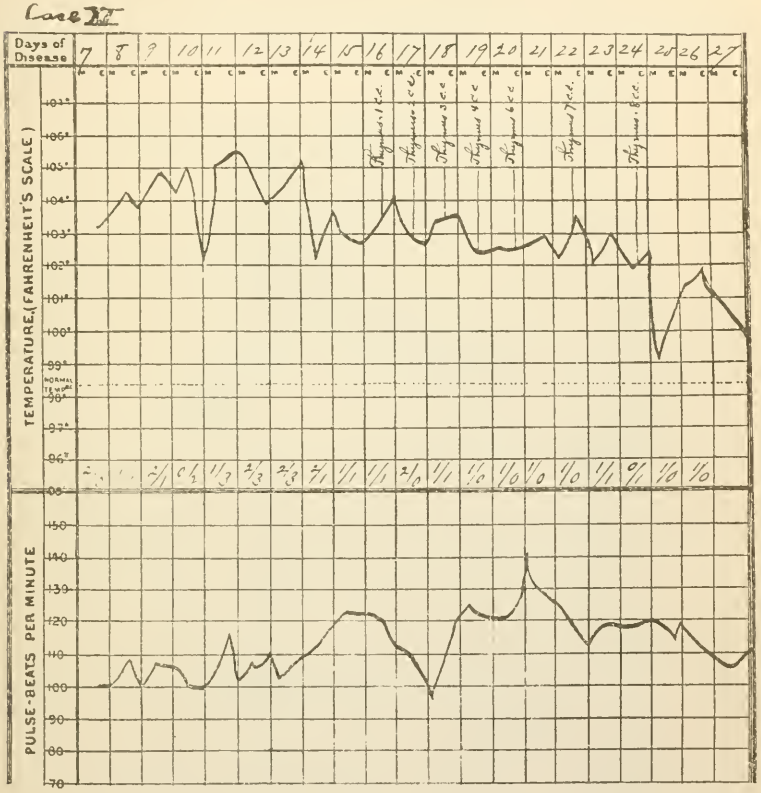
On the fifth, sixth, seventh, and eighth days he was injected with the extract. On the tenth and eleventh days his temperature was normal, almost, and he appeared quite bright. Then he had a chill, followed by resumption of fever for three days. During the time, he was injected with five c.c., and then with six c.c., of extract. Fifteenth day: temperature ranged about 99 degrees. Then followed a marked relapse, and this lasted for a week. Injections were not resumed for want of material, the supply of extract and first cultures gave out, and the disease ran its usual protracted course. Convalescence was not well established until the seventh week, and the patient remained for a long time in the hospital. It is fair, I think, to assume that had the injections been resumed for a few days, the course of the disease might have been shortened by two weeks.

Case X. A. P., Italian.

This case closely resembles the preceding. The injections



were started on the eighth day, and the temperature tended downward until the twenty-ninth day, when a relapse began, and the fever proceeded to run its usual slow course. The case was a complicated one, and continued in the hospital over two months.



The first injections promised well, but during the relapse should have been continued to cause a crisis, if possible. This case, also Case XII., bore the experiment of an unusually rapid increase of dosage with perfect impunity, owing to its severity.

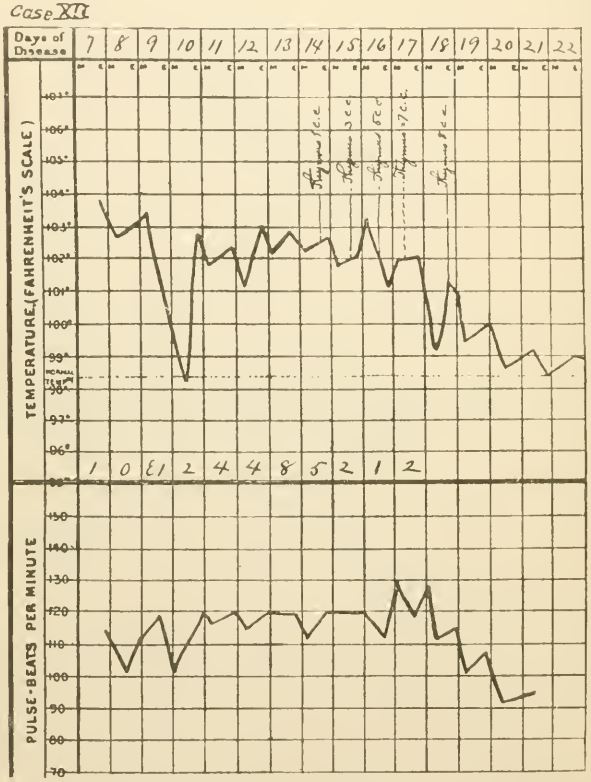
Case XI. Brenda Davidson, R. 29.

She entered on the eighth day of her attack, anaemic and considerably prostrated.

Injections were not started until the sixteenth day. They were continued until the twenty-fifth day, when there was

an attempt at a crisis and considerable improvement in the patient. But the course of the fever was resumed, and convalescence took place by lysis. Although the injections were started late, they certainly succeeded in correcting the diarrhœa, and as the general condition of the patient improved, helped rather than hindered her final recovery.

Case XII. K. S., 23 years, S.



Entered on the seventh day of disease. Face flushed. Tongue: thick, dry, brown coat; spleen enlarged, and rose spots present: also some gurgling. Diarrhœa and characteristic stools. Continued headache.

Injections begun on the fourteenth day, and continued through the eighteenth. *The diarrhœa ceased after the second injection, and no further headaches.*

On the twentieth day temperature was normal, and she

appeared very much brighter. Convalescence has continued since that time. She is still in the hospital, but feels quite well.

Case XIII. H., wardmaster.

The injections were not started until the third week, and then as a last resort, as he was a very sick man. No effect resulted from the injections, as might have been predicted, and the patient died from intestinal haemorrhage during the fourth week.

Of these thirteen cases, the results in eight have been as satisfactory as could be expected; in four the course of the typhoid has not been materially shortened, and one death from haemorrhage occurred.

One case of typhoid fever (in Ward T) was treated with injection of the plain sterilized thymus extract (without inoculation of typhoid bacilli, for control experiment). There was no appreciable change in the chart, or in the condition of the patient, at any time. This shows that the presence of the typhoid organisms is essential to the success of this treatment.

In reporting such a small number of cases, comparatively, it would be quite absurd to draw any conclusions. I am sure that the injections given have not been in any way injurious to the welfare of the patients, while, on the other hand, I believe that several of the cases have been materially benefited by this method of treatment.

If my cases can be added to those previously reported, there would be a total of ninety-eight (98) cases of typhoid fever treated with this extract. Where the treatment has been started reasonably early, there has not been a single death as yet recorded. I believe that this is worthy of further trial, and after two or three hundred cases have been reported, some positive conclusions can be reached. I would suggest the use of a more concentrated and stronger extract, and, if possible, earlier and more persistent injections than could be given in the cases hitherto reported.

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XXI.

THE CITY HOSPITAL MEDICAL SOCIETY.

By Abner Post, M.D., and A. S. Knight, M.D.

A series of medical meetings have been held in connection with the hospital during the past year, as the result of a desire to make the clinical and pathological material of the hospital more useful. These meetings have been designated as the City Hospital Medical Society. The society membership comprises all the staff, with the house officers and such former internes as care to attend: but the society can scarcely be said to have an existence as such, as there is neither constitution nor by-laws, nor roll of members, nor membership fees. In short, the whole affair is informal. Its only officers are a president and a secretary. Its meetings are held in the library, which affords admirable accommodation for the purpose. Usually the order of procedure is as follows:

1. Secretary's report.
2. Exhibition of cases.
3. Discussion of the cases which have been exhibited.
4. Exhibition of pathological specimens.
5. Presentation of other matters of general interest to the hospital.

The secretary's report is intended to be little more than a catalogue of the cases and specimens shown. Only the salient points of cases are talked about while patients are in the room. The physical peculiarities are pointed out, and the patients are then dismissed. The patients are all exhibited in this way before any general discussion is entered upon, and all are dismissed within half an hour after the meeting is called to order. By this method the disturbance in the ward from which a patient is brought is reduced to a mini-

mum, and any convalescent or out-patient who comes from his own home is allowed to return with very little delay.

These exhibitions have been practically limited to such patients as present lesions that can be demonstrated to a number of individuals at the same time. Patients that require the use of the stethoscope or microscope to demonstrate their peculiarities have seldom been shown.

So far it has been necessary to reject many cases offered for demonstration, and a rather severe censorship has been exercised in the selection of material best adapted to the meetings; but all connected with the hospital have gladly coöperated in making the meetings useful, without much regard to their personal wishes.

After the exhibition, cases are again considered in the order in which they were exhibited, when they are more freely discussed than would be possible in the patients' presence. No general discussion is favored, but after the physician in charge has said all he wishes to say, additional remarks are often made by others who have made some special investigation or examination in connection with the cases.

It occasionally happens that cases shown one month clinically are shown the next month as seen by the pathologist. As a rule, only gross pathological specimens have been exhibited, as the audience is too large for the use of the microscope. The variety of material has been great, as will be seen farther on.

The miscellaneous matters which have been presented concern chiefly such things as are accomplished in one branch of the hospital, but of which the main body of the hospital workers have little information. For instance, reports have been given of the progress in the use of antitoxine, of the work done in the pathological laboratory, and of the progress on some of the new buildings.

In general, only things connected with the hospital have been considered: no written papers have been read, and no reports of the meetings have been published.

The great variety and the remarkable character of the material utilized at these meetings seems worthy of record, and the programme of the different meetings follows:

Dr. Mason presented a man with multiple sarcoma of the skin.

Dr. George B. Shattuck showed a woman with myxoedema, and another with exophthalmic goitre. Remarks by Drs. Mason and Withington.

Dr. Burrell showed a man after Kraske's operation for carcinoma of rectum.

Dr. Burrell presented a man with pistol-shot wound of brain, following attempted suicide, and Dr. Prince discussed the location of the ball according to the clinical signs.

Dr. Councilman showed the organs from a case of acute miliary tuberculosis with subcutaneous emphysema, the original infection starting from an old tubercular ulceration in the intestine and extending through the thoracic duct.

The following cases have been shown at subsequent meetings:

The result of another operation by Kraske's method for carcinoma of the rectum, six months after the operation.

United fracture of patella, showing result of immediate suture.

Fracture of the patella for the second time in a new place, so that the middle piece was united to the upper and lower pieces by a long fibrous band.

Anthrax, successfully operated upon.

Result of suprapubic cystotomy for stone. Union by first intention.

Tuberculous osteo-arthritis of knee, operated upon by removing all the diseased tissue, closing the wound by sutures, and applying plaster bandage.

Compound fracture and dislocation of ankle. Reduced and sutured. United by first intention, without rise of temperature.

Capsular ligament of the humerus, shortened by an original operation to prevent recurrent dislocation of humerus.

Recovery from penetrating stab-wound of abdomen.

Congenital hydrocephalus, treated by repeated aspirations.

T fracture into elbow joint, treated in acute angle position with sling, without aid of splints.

Supposed syphilitic tumor of the sterno-mastoid.

Femoral aneurism of short duration and obscure cause.

Result of resection of the head of humerus after a subglenoid dislocation of eleven months' duration.

Result of operation after fracture and dislocation of nasal bone.

Multiple sarcoma of the skin, a second case.

Exophthalmic goitre.

Myxoedema.

Chronic general psoriasis, treated by thyroid extract.

Multiple neuritis, simulating acute ascending (Landry's) paralysis.

Mitral insufficiency, improved by large doses of digitalis.

Carcinoma of stomach, liver, and omentum.

Myelogenous splenic leukaemia.

Ascites, following acute exacerbation of chronic parenchymatous nephritis. In the ascitic fluid was found evidence of marked proliferation of endothelial cells of peritoneum.

Probable acromegalia.

Left-sided hemiplegia, of syphilitic origin.

Probable syringomyelia.

Movable kidney.

Ataxic paraplegia. No history of syphilis.

Persistent hiccough, due to reflex neurosis, and controlled by draughts of water until the medicine was discovered to be water by the patient.

Essential pernicious anaemia: two cases, treatment with bone marrow, followed by marked improvement. No cause in the history.

Extensive dermatitis exfoliativa, following a 15-grain dose of quinine for malaria.

Late hereditary syphilis, especially marked in the liver, in boy 22 years old.

Hysterical paralysis.

Organs from case of multiple sarcoma.

Giant-cell sarcoma of lower end of femur, following an old unrecognized fracture of the condyle.

Fibroma of uterus.

Two specimens of cancer of liver, preserved by formaline.

Sarcoma of retro-peritoneal lymph glands.

Adenoma of prostate, through which the urethra passed at an acute angle into bladder.

Fresh specimens of perfectly circumscribed carcinoma of breast.

Carcinoma of cervix uteri, limited entirely to the cervix.

Spleen from case of myelogenous splenic leukaemia.

Thrombosis of portal vein and metastatic abscesses all through the liver, following operation for appendicitis. The man had general infection of streptococcus.

A dirty splinter of iron removed from the hand in which it had been imbedded for two and one-half months without causing inconvenience.

Fresh malignant tumor from the bladder.

Unique teratoid tumors of brain and testicles, nearly every tissue of the body was found in the brain.

Cysticercus cellulosa of brain.

An obstructed intestine, after operation for femoral hernia.

Specimen and description of the operation of ligating the innominate artery for aneurism. About four inches of lead-pencil removed from neck of Italian, where it had been imbedded by stabbing.

Organs and clinical history of a case of general tuberculosis which had probably started in the vesiculae seminales.

Gastric ulcer from a case in which there had been copious hemorrhage from stomach one and one-half years previously. Subacute and chronic ulceration of stomach, and erosion of gastric artery.

A lung from case of pneumonia, showing normal lung tissue, gray hepatization, and red hepatization.

A bladder — small, and covered with diphtheritic membrane as result of gonorrhoea.

Cancer of stomach, with large intestine adherent to stomach wall, and ulceration through the adhesion. As a result, food went undigested into large intestine and set up irritation and degeneration, so that earlier vomiting was followed by diarrhoea as the prominent symptom.

An intestine with multiple strictures due to extension of cancer of the pancreas into mesentery, and so causing obstruction in jejunum and rectum.

Dr. Sears described the results of diphtheria treatment before and since the use of antitoxine.

Dr. Munro told his experience during ten days of substitution for Dr. Gavin. Nine abdominal abscesses operated upon, five appendixes; three of them in one night, one after the other.

Dr. McCollum described recent experiences in South Department. [The New Wards for Contagious Diseases.]

Dr. Cushing related his removing the cicatrix one year after operation for hernia by McBurney's method, in which the hernia had again protruded.

Dr. Cushing described a fibro-lymphangioma removed from the ankle of an old man. It had grown very slowly for twenty years, and resembled a ganglion before the operation.

Dr. Lovett discussed the breaking down of nurses' feet and the best methods of preventing and curing it.

The smallest attendance was at the first meeting, Dec. 13, 1894, 42 present.

The largest attendance was on Dec. 12, 1895, 79 present.

Average attendance, 60.

These meetings have been very successful in the general interest they have excited. The attendance has been large, and leaving before adjournment has been exceptional. They have required comparatively little effort on the part of any one individual. The material has been so abundant and so varied that there has been something of interest to every one present. Discussion has been so limited that the meeting has had little opportunity to grow dull or wearisome; on the other hand, it is a fair criticism to say that no subject has been thoroughly investigated. The meetings must be considered as suggestive rather than exhaustive, and it would probably not be unfair to say that the majority of those present each evening have found some subject for future study after going home. The meetings have also had the

advantage of novelty, for no society has existed in this vicinity before which so much clinical and pathological material was or could be displayed. In fact, it may be said that the display of material has been considered of more importance than any words that could be said about it. The presentation of the interesting cases in the different services of the hospital has served to show physicians and surgeons what each was doing, and to enlarge the sphere of knowledge of all. By mutually interesting each in the others' work, the meetings serve to join the staff by a bond of common interest.

These meetings have accomplished another less obvious, but little less valuable, result. They have brought back to the hospital men who have served it as house-officers, have kept alive their interests, and made the hospital to them a source of present advantage as well as of pleasant memories.

XXII.

From the Pathological Department of the Boston City Hospital.

A STUDY OF THE LESIONS IN SELECTED AUTOPSIES.

By W. T. Councilman, M.D., and F. B. Mallory, M.D.

ARTICLE I.

FIVE CASES OF ACUTE GENERAL MILIARY TUBERCULOSIS, SHOWING THE SOURCE OF THE GENERAL INFECTION AND THE CHARACTER OF CERTAIN OF THE VASCULAR LESIONS IN TUBERCULOSIS.

Case I. — J. C. *Anatomical diagnosis:* Acute general miliary tuberculosis. Old tuberculosis of lungs. Tuberculous aneurism of aorta. General staphylococcus infection.

Body well developed, fairly well nourished.

The lungs contain at apices and elsewhere throughout the tissue a few yellowish calcareous masses surrounded by a dense gray capsule of fibrous tissue. On section they were everywhere studded with small, grayish, slightly elevated nodules. The lungs very hyperaemic, voluminous, and denser than normal. Pieces cut from the most affected portions barely float in water. The pulmonary arteries and veins normal. The bronchial glands are somewhat pigmented, but not caseous.

The heart of size corresponding to that of body. The valves normal. In the thoracic aorta, 6 cm. above the coeliac axis and on the anterior side, there is a small, sharp, longitudinal depression similar in appearance to the exit of a small artery. This depression is 2 mm. in length. A probe passed into it penetrated 2 mm. Immediately outside of the artery at this point is a round projecting growth, 1 cm. in the greatest diameter, which is transverse to the artery and 6 mm. in the other direction. This

nodule on the outside is perfectly smooth, of a reddish-gray color, and in it small whitish specks can be recognized.

On section through the artery and nodule the depression is seen to pass directly into this nodule. In the intima of the artery immediately beneath this and over a distance of 1 cm. there are innumerable gray nodules projecting from the surface. In the abdominal aorta, lower down, there are a few scattered single elevations.

The liver large, pale, yellow. No tubercles could be distinguished with the naked eye. The liver on section of a pale reddish color, and of rather soft consistency.

Spleen greatly enlarged: capsule smooth, and of a pale reddish color. On section malpighian bodies not prominent. The organ filled with tiny whitish points, which are so numerous that they must have accounted in large part for the swelling of the organ.

The kidneys large: capsule easily stripped off. Beneath the capsule and on the cut surface great numbers of grayish and whitish yellow tubercular nodules, which are confined to the cortex. The small intestine, about 20 cm. above the ileocaecal valve, contains a smooth tuberculous ulcer, the peritoneal surface of which is covered with a number of grayish tubercles. No trace of tuberculosis is found in the abdominal lymph-glands.

On the upper surface of the cerebellum there are a few small tubercles.

Bacteriological Examination.

A small amount of soft granular material was removed from the depression in the aorta and examined for tubercle bacilli, showing these in large numbers.

Cultures made from the lungs give an abundant growth of staphylococcus aureus. The single colonies very yellow.

Heart, liver, and kidneys give a few colonies of staphylococcus aureus.

Sections of the aorta were made through the small depression. Macroscopically these sections show a sharp depression in the wall of the aorta apparently passing through the intima and the media. This small cleft opens into a

wider space, which extends into and probably beyond the adventitia, and in the middle of this round opening there is a small mass of detritus. On either side of this, in the stained sections, is an area of deep blue staining tissue which formed the nodule seen on the outside of the aorta. This bluish tissue encroaches on the media, which is thinned around the opening.

On microscopic examination with a low power the aorta presents a normal appearance up to within a short distance

FIG. I. Cross section of aorta through tuberculous aneurism. *a*, intima. *b*, muscularis. *c*, adventitia. *d*, aneurism with clot. *e*, caseation extending around muscularis into intima.

of the cleft. The upper portion of the muscularis appears with a low power to be normal. At the edge of the cleft the intima of the artery appears to pass down into it, covering over the sharp fracture of the media. Just above the muscularis, on either side of the cleft between that and the upper layer of the intima, there is a small area of caseous necrotic tissue. The upper layers of the media present a normal appearance up to the cleft. The lower layers of the media appear to be gradually destroyed, as they approach the cleft, by necrosis, which gradually advances from below, so that the edge of the media is to a certain extent oblique. The intima is perfectly normal a short distance above the cleft: as it approaches the cleft there is a thin layer of necrotic tissue between the intima and media. The upper layers of the intima pass directly into the cleft, and are con-

tinuous a short distance along its surface, when they are lost in a mass of necrotic hyaline tissue. The small cavity into which the cleft opens is lined on all sides with a necrotic tissue, which has an inner lining of hyaline, caseous, or fibrinous material. On the inside of the cavity, and free within it, is a small irregular thrombus mass.

The adventitia at the edge of the section is normal, but contains a few more cells than usual. This gradually approaches a mass of tissue which reaches its greatest development on either side of the cleft. This tissue is largely caseous and necrotic. There is no tissue within it which would ordinarily be recognized as tuberculous tissue. It is not composed of single masses of tissue, as a conglomerate tubercle, but is principally made up of masses of dead cells, among which there is a great deal of nuclear detritus and some well-preserved leucocytes. On the edge of the cavity there are great numbers of these leucocytes, making a wall just inside of the necrotic tissue.

On examination of the necrotic mass with an immersion, the cells composing it are seen to be round, of about the size of leucocytes. In most of these cells the nucleus has been destroyed, giving rise to a large amount of chromatin fragments. Many of the cells have the characteristic appearance of the polynuclear leucocytes. At various places, especially on the edge, mixed with these cells, there are some of an epitheloid character, and there are also mixed with them small detritus-like masses, probably the remains of the original tissue.

In the edge of the wall of the cavity the necrotic tissue is exceedingly irregular, and looks very much like hyaline fibrin. Numerous red blood corpuscles are found in the irregularities on the edge.

The thrombus mass within has the character of a very loose white thrombus. Under an immersion the media at the edge of the specimen shows an interesting condition. On one side there is a dark line which is made up almost exclusively of leucocytes. Even under the immersion the fracture of the media is perfectly clear and sharp. The sharp edge of elastic fibres is seen. This fracture abuts on

a tissue formed of leucocytes, most of which are necrotic, with some fragments of other tissue around them. This tissue extends up around the edge of the broken media, beneath the upper layer of the intima. Adjoining the fracture, the muscular fibres have lost their nuclei, they stain diffusely blue with haematoxylin, and are coarsely granular. No change can be made out in the elastic fibres. Here and there, where the media adjoins the necrotic focus beneath, the nuclei are broken up into nuclear detritus, and the muscle fibres are granular and partly broken down. In this part of the tissue the elastic fibres can be recognized.

The sections stained for tubercle bacilli show these in the greatest numbers in the necrotic tissue of the tumor mass. They are present both in large masses and scattered diffusely throughout the tissue. They are also found in considerable numbers in the thrombus mass at the bottom of the cavity.

In almost all of the sections, large masses of bacilli are found just at the edge of the fractured media and in the tissue around this; also in the necrotic mass which extends up into the intima. The masses of tubercle bacilli here are frequently spiral, similar to the appearance first described by Koch in the kidney. The muscular coat just at the edge of the necrosis offers interesting relations. The tubercle bacilli are seen in some places in great numbers in the necrotic tissue. They are found apparently in small clefts in this tissue and alongside of the elastic fibres. In places, a long row of tubercle bacilli is found in a space apparently between an elastic fibre and the muscle. From their arrangement the bacilli give the idea of lying in preformed spaces.

On the surface of the aorta, just beneath the lesion described, there are a series of small nodules just visible to the naked eye. On microscopic examination these are found to be within the intima. There is a thin layer of intima going over the surface of each one, apparently composed of nothing more than endothelial lining. Beneath this, and apparently on the surface of the intima, in places projecting slightly into it, there is a considerable mass of necrotic tissue. The

tissue seems to be composed of necrotic fibres; scarcely any cells can be seen within it. In places on the edge there are a few epitheloid cells. A few leucocytes are also found within it. Most of the structure is immediately on the surface of the intima, but in places the necrosis extends directly into it. The muscularis beneath it is perfectly normal. The lower layers of intima beneath it are free from cellular infiltration or any pathological condition.

All of the sections show about the same condition, but in one of them there is at one side a well-marked giant cell formation, with epitheloid cells around it. On staining for tubercle bacilli, the mass shows a very few bacilli scattered through the necrotic tissue.

On account of the acuteness of the process, a careful investigation was made of the tubercles in the kidney and lungs.

Kidney.— Sections of the kidney show to the naked eye numerous very small brightly stained masses scattered throughout them. In sections perpendicular to the surface some of these masses are round, but the most of them are elongated in the direction of the tubules. On microscopic examination with a low power these vary in size. Some are exceedingly small, others larger. They show in their interior more or less altered renal tissue. The tubules can be recognized as reddish masses extending through it: and glomeruli sometimes entirely caseous, sometimes only slightly altered, are frequently found in the middle. These nodules are almost entirely confined to the cortex. In one place in the pyramid there is an area of cellular infiltration around one of the collecting tubules. This area, however, can be followed up and found to be continuous with a mass in the cortex. In one place there is a very small nodule, with a glomerulus immediately in the centre. In this glomerulus there is considerable growth of the capsular epithelium and of the epithelium of the tubule leading off from it. The glomerulus itself in places shows an increase in its cells. Around the glomerulus there is a dense tissue, in which some of the tubules can be recognized. These tubules are filled with epithelial cells,

and in the tissue about them there are great numbers of cells of an epitheloid character. Karyokinetic figures are found in the surrounding tubules, and here and there a leucocyte which has wandered in between the epithelial cells. The interstitial infiltration extends for some distance into the surrounding intertubular tissue. The epithelium of the tubules is swollen and granular, and in places exquisitely hyaline. The outlines of the cells are irregular, and the tubules are filled with a small amount of detritus. In one place a nodule is immediately around a small artery which shows some hyperplasia of the intima. In some of the tubercles the tissue is so thick and dense that nothing can be seen of the renal tissue. In these places there is usually a great deal of nuclear detritus and necrosis, and in the necrotic mass there are large numbers of leucocytes of the most irregular form. The tubules in these places are unrecognizable. Here and there in the tissue there is a great deal of cellular infiltration between comparatively normal tubules. It is very probable that such places represent the outer edge of tubercles lying above or below the plane of the section. In all of the larger masses there is a great deal of necrosis in the centre, with fragmented nuclei.

Tubercle bacilli are found in considerable numbers in the tuberculous tissue and in the glomeruli. In the glomeruli they are found in the vessels. The vessels containing them are occluded, and the nuclei about them are increased in number. The bacilli are also found in considerable numbers in the tubules, both in those which are converted into masses of detritus and also in tubules which are very little altered. Tubercle bacilli are relatively in the greatest numbers in the smaller tubercles and on the outside of the older ones. The tissue was searched carefully for the presence of bacilli in the tubules at a distance from the tubercle, but they were not found. The kidney, save in the immediate vicinity of the tubercles, shows no change, although a few hyaline casts were found in the pyramids.

Lungs. — In the lungs the alveoli everywhere contain a large amount of coagulated albuminous exudation, repre-

sented by a more or less granular mass. In this there are numbers of large pale swollen cells. The blood-vessels are dilated, and the walls of the alveoli are thicker than normal. Many of these large cells in the alveoli contain pigment. Most of them have the character of epithelium. There are but few leucocytes in the alveoli. The congestion of the lung is extreme.

Tubercles are present in large numbers. These are usually represented by an area in which two or more neighboring alveoli are filled with a granular mass, containing large round necrotic cells with a few leucocytes. The blood-vessels of the walls of the alveoli are occluded by fibrin, and there is a very slight amount of fibrin in the alveoli between the cells. At the outside of these masses in the adjoining alveoli there is some growth of the alveolar epithelium, but this alveolar growth plays no part in the formation of the tubercles. The tubercles were much more evident to the naked eye than on microscopic examination, and there is really very little difference between the tubercles and the lung elsewhere. The most marked characteristic of the tubercles is not any peculiarity of structure, but the greater number of cells and the necrosis.

Examination for tubercle bacilli shows them to be present in varying numbers, both in the tubercles and in the alveoli immediately adjoining them. In the latter place they are frequently contained in the larger cells. Single bacilli were also found in large cells in the alveoli at a distance from the tubercles.

It is evident that we have to do in this case with an aneurism of tuberculous origin. This tuberculous process originated in the adventitia of the vessel, and from this extended into the media. It is not probable that there was any formation of tuberculous tissue in the media; but a more or less extensive necrosis, or hyaline, or fatty degeneration was produced by the chemical products of the tubercle bacilli in the nodule adjoining the media. The necrotic or degenerated muscular tissue broke directly across, and the intima was forced into the depression by the pressure of the blood.

This depression was probably at first completely covered by the intima, and was deepened by the pressure from within. Such sharp fractures of the media of the aorta are not very uncommon in cases of arterio-sclerosis. The case is of further interest as showing a possible cause for the formation of aneurisms. It is possible that the cases of aneurisms in individuals with otherwise normal arteries may be due to infectious processes which are localized in the adventitia, and which may lead to destruction or degeneration of the media.

The tissue which was outside of the aneurism, and which the presence of tubercle bacilli showed to be undoubtedly tuberculous, was not characterized by the production of tuberculous tissue. Indeed, without the association of the miliary tubercles, and without the presence of tubercle bacilli, there would have been no evidence of its tuberculous character. There was little probability that it originated in the intima. The miliary tubercles of the intima of the aorta, below the aneurism, which were evidently due to infection from this, did not show any tendency to extend into the wall. Our study of the tuberculous process in vessels in which the infection comes from the interior shows that there is little or no tendency for the process to extend from the interior of the vessel outwards. This is probably due to the thrombus formation, and to the chemical products of the bacilli being carried off by the blood current.

The tubercles, both in the lungs and kidneys, particularly in the former, show the same absence of tuberculous tissue which characterized the process in the aorta. In the lungs the tubercles represent small foci of caseous pneumonia, and tissue formation does not seem to play any part in their structure.

The cultures from the case show a general infection with the staphylococcus, and in the sections of the aorta a considerable number of foci were found scattered through the tissue and in the small thrombus in the aneurism. They were not found in sections of the other tissues.

Case II. — W. K. *Anatomical diagnosis:* Tubercular ulcers of intestine. Tuberculosis of mesentery glands. Tuberculosis of thoracic duct. General haematogenous miliary tuberculosis. Subcutaneous emphysema. Streptococcus septicaemia.

Body large, tolerably well nourished. Subcutaneous emphysema over entire chest and neck. Subcutaneous fat small in amount; muscles red and well developed. Peritoneum smooth. Liver and spleen free from adhesions. The liver enlarged. A small amount of gas in subcutaneous tissue of thoracic wall.

On opening the chest, there was an escape of gas from the right pleura. The tissue in the mediastinum was infiltrated with air, forcing apart the meshes of connective tissue. There is also air in the tissue of the pericardium, but none in pericardial cavity. There is considerable air beneath the pleura around the hilus of the right lung; a small amount also around hilus of left lung; no air beneath the parietal pleura.

Lungs.—Both lungs free from adhesions. On section, hyperaemic and denser. In the bronchi a large amount of muco-purulent exudation. Throughout both lungs the tissue is studded with very fine miliary tubercles, homogeneously distributed throughout the tissue.

Heart. — Of medium size; valves normal; myocardium normal. There is no gas in the vessels of the body anywhere.

Liver. — Is slightly enlarged; lobules prominent; periphery of lobule rather pale. A few tubercles visible to the naked eye.

Spleen. — Enlarged; capsule tense; tissue comparatively soft. Innumerable miliary tubercles, the largest 1 mm. in diameter, are scattered through the tissue.

Kidneys. — Enlarged. Immediately beneath capsule there are numerous small whitish tubercles with vascular injection around them. On section of kidney a few tubercles at various places in the tissue are seen.

Intestines.— In ileum, about one metre above valve, there is a tuberculous ulcer with irregular edges which are not ele-

vated above the surface. In places the edges contain small caseous points. The ulcer looks as though in a state of healing. Adjoining this ulcer there is a small ulcer of the same character. Lower down in the immediate vicinity of the valve, there are smaller and comparatively fresh ulcers. The lymph-glands in the mesentery are enlarged, particularly the glands in the immediate vicinity of the cæcum.

Glands at root of mesentery are enlarged; the enlargement more marked than in the lower glands, but the tuberculosis not so far advanced.

Thoracic duct. — The thoracic duct, in its entire course through the thorax, is dilated and filled with a thin, slightly turbid fluid. In the upper portion it is enlarged to threefold its normal size and is solid. The opening into subclavian vein cannot be traced. On opening the duct small whitish nodules, tubercles, are found at various places on the internal surface. Its upper portion for a distance of 6 cm. is lined with a caseous material. In most part the surface of this is smooth, and the duct has a definite though irregular lumen. In the uppermost part this material is more or less softened, and the lumen cannot be followed.

Brain. — Brain and meninges intact. Meninges in Sylvian fissure injected, but no tubercles can be distinguished in the course of the vessels.

Testicles. — Small, extremely flaccid: no evidence of tubercles in substance of gland.

Bladder, stomach, and pancreas. — Normal.

Bacteriological examination of organs at autopsy.

Cover-slips from fluid in thoracic duct, stained for tubercle bacilli, gave negative results.

Heart's blood. — Pure cultures of numerous very fine colonies of streptococci, which in water of condensation grow in long chains.

Emphysematous tissue in mediastinum. Numerous colonies of streptococci.

Spleen. — Pure cultures of streptococci. Numerous colonies.

Liver. — Pure culture of enormous numbers of colonies of streptococci.

Lung. — Pure culture of enormous numbers of streptococci.

Kidney. — Numerous colonies of streptococci.

In this case the subcutaneous emphysema is evidently due to rupture of some pulmonary vesicle near the hilus of the right lung. From this place the air made its way into the general connective tissue of the thorax and into the right pleural cavity. It is possible that the general streptococcus infection may have come from the lungs at the point of rupture, for they were found in large numbers in the cultures made from the emphysematous tissue.

The main interest in the case centres in the tuberculosis of the thoracic duct and the relation of this to the general miliary tuberculosis. The infection must be assumed to have been primary in the intestine. The intestinal ulcers represented the only old tuberculous process in the body, and the tuberculosis of the mesenteric glands is immediately due to the ulcers. The evident age of the ulcers, and the infrequency of the intestinal ulceration of haematogenous origin, would not lead us to suppose that they were due to the same source of infection as the miliary tubercles.

Tuberculosis of the thoracic duct is a rare affection, and one which has received but little anatomical investigation. The first description of the affection comes from Sir Astley Cooper, who found in a case of phthisis the duct dilated, and filled with a soft caseous mass. The connection between tuberculosis of the duct and general miliary tuberculosis was first recognized by Ponfick, who found in cases of general miliary tuberculosis tubercles in the intima of the duct. Weigert published, in his description of tuberculosis of the veins in their connection with miliary tuberculosis, two cases of tuberculosis of the thoracic duct. There is no histological description of the lesions in either of Weigert's cases. In both there were miliary tubercles of the duct, combined in one case with fibrin formation. Stilling investigated the condition of the duct in a number of cases of tuberculosis of the uterine and abdominal lymph-glands. In one he found the condition described as tuberculosis, but he considered the nodules in the duct as thrombi, in spite of

the fact that in one of them he found endothelial and giant cells. Orth, in his text-book, figures a tubercle nodule in the thoracic duct without any histological description. The figure shows a projecting nodule without any definite structure. From the meagreness of the literature on the subject, and the absence of any clear description of the character of the lesions, this case, from the extent of the process and its evident connection with the acute general miliary tuberculosis, seems worthy of description.

Sections were made at various places in the thoracic duct after hardening in alcohol. The most of the sections were made through the upper portion of the duct at the area of greatest change. Sections were also made at the lower portion of the duct, where a lymph-gland 6 cm. above the diaphragm was adherent to its outer surface. Sections of the duct, where not involved in the tuberculous process, show a wall formed of connective tissue with a few small cells most numerous close to the surface. The lumen is lined with a thin layer of endothelial cells. There appears to be no elastic or muscular tissue in the duct. Like other lymph-vessels, it represents rather a space in the connective tissue, lined with endothelium, with some thickening of the connective tissue around it. The lymph-gland adherent to the duct shows a well-marked tuberculosis, but this does not extend to the wall. The tuberculosis of the gland is interesting on account of its close proximity to the duct, because it can lead to a tuberculosis of the duct by extension of the tuberculous process.[1]

Sections of the duct involving the small nodules macroscopically visible and considered as miliary tubercles show these to be composed of a thrombus clinging to the wall of the duct and in one place closely associated with it. The endothelium is absent where the thrombus is adherent. The thrombus is composed of lymphoid cells imbedded in a very fine fibrillar reticulum. At another place in the same sec-

[1] In a case autopsied by one of us several years ago, this gland, whose situation seems to be constant, was caseous and adherent to the duct. In the wall of the duct, immediately over the gland, there were numerous tubercles, and scattered tubercles were found in the upper part of the duct.

tion there is a similar mass which has been stripped off from the duct by the process of cutting. The cells in these masses are almost entirely lymphoid, but among them there is a number of much larger cells, larger than the large mononuclear leucocytes of the blood. In the lower layer of one of the thrombi, close to the duct, there are numbers of polynuclear leucocytes. The stroma is entirely composed of fibrin, and there is nothing in the appearance of the mass to suggest tuberculosis.

Sections through the upper portion of the duct, where the lesion macroscopically appeared evidently tuberculous, showed a similar condition to that found in the tuberculous thrombi of the veins, to be described later. There are large caseous necrotic masses adherent to the wall of the duct, partly involving the wall, and extending into the surrounding connective tissue, and projecting as irregular, more or less broken masses into the duct. The larger of these are not covered by the inner lining of the duct. These masses are composed of a reticulum, evidently fibrinous in character, the meshes of this being in part fine, in part large and hyaline. In this there are a large number of granules resulting from nuclear destruction. In the largest thrombus the nuclear detritus is so extensive that it seems to form the greater portion of the mass. This necrotic fibrinous material is in direct continuity with the lumen of the duct. In the angle between the duct and the thrombus there are numbers of large cells, with epitheloid nuclei, which probably result from a proliferation of the lining endothelium. In places the wall of the duct can be traced beneath the thrombus. In others the wall cannot be made out, and the process extends into the surrounding tissue. There are no giant cells, and only at the outside, where the thrombus comes in immediate contact with the wall of the duct, are there any epithelioid cells. It gives the impression of a thrombus composed of fibrin and leucocytes, with extensive necrosis of the latter. There is a dense cellular proliferation in the tissue surrounding the duct. Over one of the large thrombus masses the endothelial lining of the duct can be traced for a short distance, when it becomes lost in the fibrin and the necrosis.

In some places the necrotic tissue found elsewhere in the centre of the thrombus is in direct continuity with the lumen of the duct. In others, on the surface, there is a fresher mass composed of a rather loose reticulum of fibrin, which probably represents a fresh deposit. In the lower layers of this, where it is in contact with the old clot, there are large numbers of lymphoid cells with a few leucocytes among them. In the upper layers the cells are much fewer in number.

Examination for tubercle bacilli shows these to be present in enormous numbers everywhere in the large thrombus. They are most abundant in the necrotic portion, and in direct continuity with the lumen of the duct. In the fresh thrombus mass deposited on the old, a few single bacilli are found. In the small thrombi they are most abundant in the lower layer next to the wall of the duct, where the most of the cells are found. A few single bacilli or groups of two or three inclosed in cells are also found in the midst of the thrombus. They are found in the adherent small fresh thrombi similar in appearance to miliary tubercles. It is evident that the process here is not one of formation of miliary tubercle from the tissue of the wall, nor of the formation of tuberculous tissue, but it is one of thrombosis with a growth of the tubercle bacilli in the thrombus, producing here, just as in the tuberculous tissue, necrosis of the cells and fragmentation of the nuclei. The process of formation of the larger nodules is evidently the same as that seen in the formation of the very small nodules in the wall of the duct which macroscopically resembled miliary tubercles. This fresh deposit on the surface of the larger thrombi is of the same character as the miliary foci. In these, tubercle bacilli in small numbers are found. It would seem possible that in the thoracic duct tubercle bacilli can become attached to the intima, and produce in this changes which cause coagulation of the lymph in contact with it. In the thrombi so formed, the tubercle bacilli can grow as a pure culture, and from this enter into the blood current.

In the kidney there are very few tubercles confined to the cortex. Most of these seem to take their origin from the glomeruli.

The liver is exceedingly fatty. The liver cells have in places entirely disappeared, probably in consequence of the fatty degeneration, and their place is occupied by fibrous tissue. The section of liver examined showed no tubercles.

The tuberculous area of the intestine is typical. It extends over a very large area, and only involves the mucous and sub-mucous coat. Tubercle bacilli are abundant.

The lung in this case was examined in serial sections. The tubercles are found in great numbers throughout the tissue. They represent very minute areas of tuberculous pneumonia with caseation. The alveoli in the vicinity of the minute caseous foci are crowded with large swollen cells, and in the advance of the caseation these cells and the alveolar walls are fused together into the caseous area. In some of the alveoli, along with these cells, there is a considerable formation of fibrin. Very few leucocytes are present.

Case III. — General miliary tuberculosis. Tuberculous thrombus in a large branch of the pulmonary artery.

Only the lungs in this case were fully examined. The lungs were brought to the Sears Laboratory from a private autopsy. The doctor who made the autopsy said there were miliary tubercles in all the organs, and he had not found any old tubercular focus.

In the lungs there is a well-marked general miliary tuberculosis. On cutting up the pulmonary arteries, a large branch near the root of the lung is found nearly filled with a white opaque thrombus which extends along the artery for a considerable distance, and into the smaller branches given off from this, completely occluding them. There is no infarction.

On microscopic examination of the lung, after hardening in alcohol, numerous older conglomerate tubercles and a great number of smaller fresh tubercles were found. The fresh tubercles contain a great number of pus cells and nuclear detritus around the periphery of a distinctly caseous centre. In the lung, around the tubercles, the alveoli contain masses of fibrin and large pale cells, mixed with white

and red blood corpuscles. The thrombus in the large artery is adherent over about one-third of the circumference of the artery. At the place where the thrombus is adherent, the wall of the artery shows no change. The thrombus is composed of fibrin and leucocytes, and much of the fibrin is in the form of broad hyaline reticulum. In all portions of it there is a great deal of nuclear detritus and a few unchanged leucocytes. There is no attempt at organization. The smaller thrombi in the vicinity of the large have the same character. Thrombi are also contained in some of the small arteries at a distance, and probably represent emboli coming from the large thrombus. In almost all of these there is a dense mass of hyaline fibrin and on this a more recent deposit of fibrin and leucocytes. The bronchial lymph-glands adjoining the large thrombus contain large numbers of tubercles. There is some diffuse caseation, but this does not, in any extent, involve the wall of the artery.

Sections stained for tubercle bacilli show these in large numbers in the thrombi in both the large and small arteries, and they are more numerous on the surface than in the middle. There are few tubercle bacilli in the older conglomerate tubercles, but the fresh tubercles contain them in enormous numbers.

In this case a thrombus containing tubercle bacilli was found in a large branch of the pulmonary artery; and from this, portions were carried away as emboli into more distant vessels. It cannot be doubted that the thrombus has served as a focus of infection for the other tissues.

Case IV. — J. S. *Anatomical diagnosis:* General tuberculosis, starting from a tuberculous ulcer of rectum, with secondary tuberculosis of retro-peritoneal lymph-glands and subsequent tuberculous thrombi of pulmonary veins, with haematogenous miliary tuberculosis of lungs, kidneys, intestine, bladder, spleen, and liver. Acute splenic tumor. General streptococcus infection.

Body is that of young negress, fairly well developed, slightly built, moderately well nourished. On abdomen and thighs well-marked liniae albicantia. Mammae well

developed; rigor mortis present. In pelvic peritoneum about 800 c.c. of slightly blood-stained fluid; subcutaneous fat small in amount: muscles slightly pale.

Diaphragm on right side fourth rib: left side fifth rib. Liver projects three finger-breadths below costal margin in mammary line: surface of liver adherent to diaphragm and surrounding structures by rather stringy adhesions.

Pericardium contains about 50 c.c. of clear fluid.

Heart. — Flabby: myocardium rather pale: valves and arteries normal.

Lungs. — Both rather firmly bound down in places by old adhesions. On pleural surface of upper lobe of left lung, grayish-yellow pin-head sized, numerous slightly elevated nodules can be seen. Both lungs voluminous and rather solid. On section everywhere both lungs thickly sown with fairly discrete grayish nodules the size of a pin's head. The pulmonary veins in numerous places show projections into their lumina. These are rounded, yellowish, smooth: and in almost any one of the larger veins one or more of these may be seen. In no case do they completely fill the lumen of the vessel.

Liver. — Is large, pale: gall-duct and bladder free: on section minute pin-point sized grayish points in large numbers may be seen here and there.

Spleen. — Large, soft, dark, showing on section perhaps one-half dozen pin-head sized grayish-yellow nodules.

Kidneys. — Of normal size. Capsule easily removed; markings well defined. On section a moderate number of discrete and confluent areas, the size of a pin's head and less, can be seen, mainly in the cortex, with a few in the pyramids.

Intestines. — In the mucous membrane of the ileum there are a few yellow, rounded, elevated nodules, the largest somewhat larger than a pin's head. There are two or three small ulcers. In rectum, beginning at anus and extending upward for two inches, there is a complete ulceration of mucous membrane; the ulcer having sharply defined ragged margin.

The retro-peritoneal lymphatic glands, lying over lumbar

vertebrae, form a mass the size of an egg. On section these are almost completely transformed into caseous masses.

The mesenteric lymph-glands are not enlarged. The veins coming from the caseous mass were carefully searched for tuberculosis of their intima, but none found. The suprarenals, uterus and appendages, and pancreas, normal.

Aorta shows slight degree of atheroma.

In the bladder, near the neck, three or four small ulcers with injected ragged margins: here and there throughout mucous membrane, — perhaps in all one-half dozen, — grayish nodules the size of a pin's head are seen.

The brain shows nothing remarkable.

Bacteriological Examination.

Spleen: sterile.

Lung: many colonies of streptococci.

Liver: many streptococci.

Kidney: many streptococci.

Heart's blood: many streptococci.

Sections embracing the masses in the veins and from other parts of the lungs were examined after hardening in alcohol. The first specimen examined shows a round thrombus mass 4 mm. in diameter projecting into one of the first divisions of the pulmonary vein. The mass has a granular centre, deeply and diffusely stained with haematoxylin, which is surrounded by a more or less definite capsule not so deeply stained. The intima of the vein passes a short distance over the surface of the thrombus on either side. The centre of the thrombus is apparently composed of cells most of which have undergone necrosis. Among these necrotic cells a few poly-nuclear leucocytes with definite nuclei can be seen. In the centre of the mass there does not appear to be any fibrin; it is composed of cells which have undergone necrosis, both cells and nuclei breaking down to form the granular mass. On the outside of this mass there is an intense infiltration with poly-nuclear leucocytes. Between the pus cells there are many large swollen and necrotic cells. Immediately on the outside of the granu-

lar centre and leucocytes there is a layer of hyaline reticular fibrin. The meshes of this are broad, it forms a definite reticulum, and is very similar to diphtheritic membrane in the pharynx. This fibrin extends for a short distance around the attachment of the thrombus. The wall of the vein to which the thrombus is attached is easily made out, and there is a marked infiltration of the wall, with small cells and leucocytes. There is no tuberculous tissue, and nothing in the histological structure that would suggest tuberculosis. In the tissue of the lung, immediately surrounding the vein, there is a considerable degree of consolidation, the alveoli being filled with large desquamated cells, and in some places with fibrin. In these areas there is some diffuse consolidation, with here and there well-defined miliary tubercles. The consolidation here does not affect all parts of the lung.

Examination with a low power shows the miliary tubercles to be the most evident process. The fibrinous exudation in the alveoli is more or less separated from the cellular, in places the exudation being entirely cellular, in others fibrinous. The miliary tubercles have a typical structure.

Sections of the same thrombus at another point show the same condition. In this section a small artery of the lung is seen in longitudinal section. This is at one point completely filled with a caseous mass, which is continuous with a tuberculous caseous mass on each side of the vessel. Here and there in the lung, in the vicinity of the tuberculous foci, there seems in places a slight organization of the fibrin in the alveoli. Most of the fibrin is in the form of hyaline masses.

Other sections show numerous thrombi of greater or less extent in various veins of the lung. In one of the smaller thrombi in another vessel a fresh process is added to the old. The thrombus is covered on the surface with firm hyaline reticular fibrin. On one side, extending from the lumen of the vein partly over the thrombus, there is a fresh deposit of fibrin in the form of fine fibrillae with numerous leucocytes enclosed in the meshes.

The lung in all of the sections shows the same condition

of miliary tuberculosis and small areas of tuberculous pneumonia. In one of the specimens, alongside of one of the arteries, which is 3 mm. in diameter, there is a mass which was at first regarded as one of these thrombi. On closer examination, the intima of the vein and the tissue immediately beneath it passes over the surface of the mass. The vessel is cut almost longitudinally, and the tuberculous mass extends in the same direction. On either side of it there is a comparatively sharp line separating it from the surrounding tissue. This line is sharper on the lower than on the upper side. At one point the mass projects directly into the lumen of the vessel, and a small amount of granular detritus is adherent to it. The mass is also composed of necrotic cells and fibrin, and differs from the others in that on the surface of it there are several giant cells. It is evident that the mass here represents a tuberculous thrombus completely occluding the lumen of a smaller vessel adjoining the old. It differs from the other thrombi in the combination of tuberculous tissue with the thrombus.

It is rather remarkable that in none of the smaller vessels of the lung are there any tubercular foci starting from the intima, although many of these smaller vessels are invaded by tuberculous foci which begin on the outside and extend from there towards the lumen. On the examination of the sections embracing the large thrombus for tubercle bacilli, these were found in great numbers, arranged in long irregular thread-like masses, and singly. They are in the greatest number immediately on the edge of the thrombus. In one place, where there is a slight fresh deposit of fibrin and leucocytes on the edge of the older thrombus, bacilli are found in this in considerable numbers.

In this case there seems little doubt that the ulcer in the rectum is the oldest focus in the body, and from this the infection extended. The thrombi in the pulmonary veins are probably due to the direct influence of the tubercle bacilli. The only other alternative would be to regard the thrombi as due to some other cause, and as afterwards becoming infected with bacilli, which find in the thrombus favorable conditions for growth. There was no general condition favoring throm-

bosis, nor were thrombi found in any of the other vessels of the body. As far as could be determined histologically, they were pure thrombi formed of white corpuscles and fibrin. The influence of the tubercle bacilli is seen in the extensive necrosis, with the formation of nuclear detritus in the centre of the mass. The leucocytes themselves may have contributed to the formation of the hyaline reticular fibrin on the outside of the thrombus, as they do in the formation of diphtheritic membrane. In but one place was there any formation of what could be regarded as tuberculous tissue, and here, in a vessel which was totally occluded, giant cells were found along the wall, and probably derived from the endothelium. The endothelium where the thrombi were adherent could not be made out, and had evidently taken no part in the cellular infiltration in the wall of the vessel. The cellular infiltration was such as would be seen in the wall where an ordinary thrombus adhered. There was no evidence of an attempt at organization, no growth of vessels or tissue from the wall into the thrombus, nor was the action of the tubercle bacilli apparent in an extension of the necrosis from the thrombus into the wall of the vessel or the surrounding tissue. Only a few single bacilli were found along the line of adhesion of the thrombi. The bacilli grew in the thrombi as a pure culture medium, and preferably in the reticular fibrin on the outside.

Case V. M. B. — *Anatomical diagnosis:* Chronic tubercular epiphycitis of left tibia. Sub-acute tuberculosis of brain (left frontal region). Tuberculosis of pulmonary veins. Acute miliary tuberculosis of lungs, spleen, kidneys, liver, pancreas, and heart. Chronic adhesive pleurisy.

Body well developed and fairly nourished.

Brain. — A few yellowish tubercles, size of pin heads and larger, in pia over vertex on left side. In frontal region is a yellowish opaque area about 4 cm. in diameter. It extends into the median fissure and to a small extent into the right frontal lobe. No tubercles can be made out on it. The yellowish deposit was most marked along the vessels of the pia. On section the process extends in places 4 or 5 mm.

into the cortex. The capillaries adjoining the area are dilated.

Left knee measures 2 cm. more in circumference than the right. On section of tibia a cavity filled with thin purulent fluid occupies the line of the epiphysis for about three-fourths of its distance on an antero-posterior section. This cavity is somewhat broader than the layer of cartilage (¾ mm.). The bone above and below shows no very marked changes. Anteriorly the cavity extends almost to the periosteum, both the compact bone of the shaft and the cartilage covering the head of the tibia adjoining the line of the epiphysis being to some extent eroded and thinned. The soft tissue just outside of this area is oedematous. The knee-joint is normal.

Lungs. — Semi-solid and studded with enormous numbers of miliary tubercles. The right lung is adherent to the costal pleura along the line between the middle and upper lobes by fibrous adhesions.

On opening up the pulmonary veins, two yellowish thrombi are found in them. Each is firmly attached to the wall on one side, and does not completely occlude the lumen of the vessel.

Liver, spleen, and kidneys contain enormous numbers of miliary tubercles. Tubercles are also found in heart muscle and pancreas. Besides the very small tubercles a few larger sized are met with in the various organs.

Sections of the thrombi in the pulmonary veins were made after hardening the tissue in 80% alcohol.

The lung shows numerous foci of miliary tubercles, many of which have somewhat the character of foci of miliary tuberculous pneumonia. Others have the character of miliary tubercles with epitheloid and giant cells. In the lung, around the tubercles, there are numbers of large, pale, swollen cells. At one place there is a large vessel, one of the main branches of the pulmonary vein, which has projecting into it a thrombus 3 mm. wide by 1 mm. deep. Macroscopically it shows a centre, slightly stained with eosin, surrounded by a zone more deeply stained. With a low power there is a sharp corner where the intima of the vessel

joins the thrombus, and the intima can be followed over the thrombus for a short distance. Where the thrombus is adherent to the wall of the vessel, the tissue is densely infiltrated with epitheloid and granulation cells, among which are some poly-nuclear leucocytes. The centre of the thrombus is composed of a granular material with much nuclear detritus around the outside of it. It contains a few leucocytes. On the outside of this there is a mass of reticular hyaline fibrin, which only in places takes the characteristic fibrin stain. This layer of fibrin is more definite on the outside of the thrombus where it is in contact with the blood. On the side towards the vessel only here and there patches of fibrin are seen together with necrotic tissue. In the same section, close to the larger vessel, a small vessel is found completely occluded by a thrombus. This smaller thrombus is in all respects similar to the large one. There is a small amount of the same reticular fibrin on the outside, and the centre is occupied by a granular mass in which cells and remains of cells, together with nuclear detritus, can be made out.

Sections from the large thrombus in the other vein present a different appearance. In one of these sections only a small portion of the thrombus is firmly united to the wall of the vessel. No portion of the thrombus here is covered by the intima, its outline is less smooth, and in places there are irregular spaces extending into it. Like the other thrombus the centre is composed of necrotic areas, and around the outside there is considerable reticular fibrin, in the meshes of which numerous red blood corpuscles are found. On one side of this there is a fresher mass which is composed of granular material and fibrin, and in this are numerous leucocytes. Epitheloid and giant cells are found in the thrombus close to the wall of the vein. Other sections of the same thrombus showed it to be invested with a complete layer of intima. In another specimen the caseous material of the centre of the thrombus extends to the surface at various places, the caseous mass being apparently in direct contact with the blood stream.

Examination of the thrombi for tubercle bacilli shows these

in great numbers everywhere in the caseous mass. They were in great numbers in the section of the thrombus which was slightly adherent to the wall of the blood-vessel. Where the caseous centre extends to the surface, considerable numbers of bacilli were found, and in the fresh deposit they were mixed with the fibrin and cells. The bacilli are usually scattered in the tissue. In only a few places are they massed in clumps. In none of the specimens are any bacilli found in the intima where it extends over the thrombus. No bacilli are found in the giant cells. In the vessel which is totally occluded by the thrombus a very few bacilli are found.

In this case, as in the first, the masses formed within the veins are thrombi. In one of them there is some formation of tuberculous tissue at the point where it is adherent to the vein, and this tuberculous tissue is intimately associated with the thrombus. It is possible that the first lesion here was a tuberculosis of the intima of the vessel, to which the formation of the thrombus was secondary. That these thrombi were sources of infection for the miliary tuberculosis cannot be doubted, from the number of bacilli contained in them, and from the opportunities which were given them for their entry into the blood stream.

This capacity of the tubercle bacillus to produce such lesions in the wall of the vessels, which lead to the formation of thrombus at that point, has been overlooked. The lesions in the veins, as described by Weigert and other writers on the subject, have been regarded as a true tuberculosis proceeding from the intima of the vessel. In but few of our cases was there any tuberculous tissue found, and when present it seemed to be formed from the intima of the vessel, in connection with the thrombus, and the thrombosis must be regarded as the primary affection.

Since these cases were investigated, on examination of a case of tuberculous broncho-pneumonia, in several of the small veins of the lung thrombi were found. In one of these there was a small white thrombus occupying a very small area in the wall of the vein. There was no tuberculosis in the wall of the vein and no tuberculous tissue in connec-

tion with the thrombus. A few tubercle bacilli were found in the intima of the vein where the thrombus was attached. In another place in the same specimen a vein was found adjacent to a bronchus filled with a tuberculous mass, with caseation in the surrounding tissue. Here the caseous process extended to the intima of the vein, involving it. On this necrotic tissue there was a fresh thrombus, and tubercle bacilli were found in large numbers in the bronchus and in the surrounding tuberculous caseous tissue.

It cannot be doubted that in many cases there is an extension of the tuberculous process from the vicinity of the vessel into the vessel, with a secondary formation of thrombus over the point. In this thrombus the tubercle bacilli find suitable conditions for growth: they can increase and infect the blood current. In the thrombus they produce necrosis of the cells contained in it, and the fibrin of the thrombus becomes converted into a hyaline mass. Organization does not seem to take place. It is possible that at the beginning of organization the tissue growing into the thrombus is destroyed, and adds to the necrotic material which it contains. In other cases, there seems little doubt that tubercle bacilli gaining entrance into the blood current can lodge in the intima of a vessel, and there produce not a tuberculosis but a thrombus. The thrombus here probably followed a necrosis of the cells of the intima. In the thrombi so formed there seems to be little or no tendency for the tuberculous process as shown by the caseation to attack the wall of the vessel; a condition which may possibly be regarded as due to the fact that the chemical products of the tubercle bacilli, as fast as formed, are removed by the blood stream, and do not exert their action on the surrounding tissues.

ARTICLE II.

TWO CASES OF TUBERCULOSIS IN WHICH THE LESIONS SIMULATE ACUTE INFLAMMATION.

Case I. W. J., age three years. *Anatomical diagnosis:* Primary tuberculosis of intestine, with extension to mesenteric lymph-glands. Sub-acute miliary tuberculosis of spleen. Acute miliary tuberculosis of liver.

Body considerably emaciated.

Abdominal cavity. — Stomach dilated to great size with gas. Coils of intestine moderately contracted. In omentum a few yellowish round and flattened tumors, size of a pin's head to a bean.

Heart. — Normal. Slight increase of pericardial fluid.

Lungs. — Non-adherent, pale. Posteriorly atalectatic in irregular bluish areas. One bronchial gland slightly enlarged, and pinkish gray with small yellow centres.

Spleen. — A little enlarged. Contained beneath capsule and in substance an occasional round yellow mass, 1-2 mm. in diameter.

Kidneys. — Normal.

Intestines. — In the ileum, about 20 cm. above the ileo-caecal valve, the wall of the intestine is irregularly thickened, and the mucous membrane studded with enormous numbers of small white and yellow tubercles. The caecum shows a similar condition for about 15 cm. The appendix is thickened, its lumen somewhat enlarged, and the wall studded with small yellow tubercles. The ileo-caecal valve is also thickened and speckled with tubercles. In the ileum, just above the valve, are two deep irregular ulcerations extending into an irregular cavity inside of the greatly enlarged ileo-caecal lymph-glands. The walls of the cavity are greenish, discolored, and from them project yellowish necrotic areas of broken-down tissue. The other mesenteric glands are much enlarged, and together form a tumor about the size of a hen's egg, in places yellow in color; elsewhere gray and translucent, but speckled with yellow tubercles. On section the glands show many cheesy and greenish-yellow softened areas.

A drop of this softened material on a cover-slip shows tubercle bacilli present in enormous numbers. In the upper part of the ileum are occasional small clumps of tubercles.

The vermiform appendix contains enormous numbers of tubercle bacilli unmixed with other organisms.

Numerous sections of the appendix and intestine were examined after hardening in alcohol and in corrosive sublimate. The mucous membrane and sub-mucosa of the

appendix is greatly thickened. The surface is irregular, and in most places the small glands of the appendix can be seen. Here and there the muscularis mucosa cannot be made out, and in these places nodular masses from the sub-mucosa project upwards, often reaching the surface. In one or two places there is a slight softening of the surface opening into these projecting masses. Beneath the mucous membrane there is an intense cellular infiltration of the tissue, both in the form of large lymphatic nodules and a more diffuse cellular infiltration of all of the tissues. At various places, especially in the nodules, there are foci of necrosis filled with intensely stained nuclear detritus.

Examination of the nodules with high power shows in the periphery normal hyperplastic lymphoid tissue. Among the lymphoid cells there are a few larger epitheloid cells, in which a few nuclear figures are found. The endothelial cells of both the blood and lymphatic vessels are increased in number. Towards the centre the tissue stains more dimly, and the cells are almost entirely poly-nuclear leucocytes. There is a great deal of necrosis, with formation of nuclear detritus. In some places the cellular infiltration and necrosis extend up to the mucous surface.

Sections of the ileum made through one of the Peyer's patches show very much the same condition as the vermiform appendix. The surface is irregularly elevated, due to an enormous hyperplasia of the lymphoid tissue beneath. There is a general swelling of this tissue, in which are numerous smaller and larger areas of necrosis, with nuclear detritus. Between these areas there is an intense infiltration of the tissue with lymphoid cells. The periphery of the nodules shows a hyperplasia of all of the tissues, and contains a few epitheloid cells among the lymphoid cells. In the centres of the nodules there is extensive necrosis of the tissue, the cells breaking down into granular material and nuclear detritus. The necrotic tissue in places extends up to the surface of the mucous membrane, but there is no ulceration present. The lymphatics just above the circular muscular coat are dilated and filled, some of them with masses of epitheloid cells and others with these and pus

cells more or less necrotic. The peritoneum is in places slightly thickened, but there is no formation of tubercles over it. In one of the sections of the intestine the centres of some of the nodules are completely softened, and the contents have fallen out.

Examination of the enlarged lymphatic glands shows a process very similar to that in the intestine. The structure of the gland is not very clear. The increased size of the gland is due to the presence of an exudation which has been coagulated by the hardening agent. This exudation is probably in part serous, and in the coagulated condition has a finely granular appearance, and partly fibrinous, as shown by the presence of large masses of fibrin. The cells are chiefly lymphoid cells, with some large epitheloid cells in their midst. Among these, in the meshes of the tissue everywhere, are numerous poly-nuclear leucocytes. There are areas in which there is abundant cellular infiltration, with extensive necrosis and nuclear detritus formation. These places are not sharply circumscribed, but they gradually fade into the surrounding structure. These areas vary in size from $\frac{1}{2}$ to 2 mm. There are no giant cells, and no tissue which could be regarded as tuberculous in character.

All the lymph-glands examined show about the same condition. In some of the sections in the lymph sinuses there are considerable numbers of large swollen cells which often contain both lymphoid cells and poly-nuclear leucocytes in their interior. Some of them contain numbers of red corpuscles. Scattered through the gland at various places, both in the lymph nodules and in the sinuses, there are large cells containing hyaline masses which stain intensely with eosin.

Sections stained for tubercle bacilli show them in enormous numbers in the intestinal lesions. They are in the epitheloid tissue in all parts, especially in the areas where the necrosis is taking place. They are principally contained in the cells. They are so numerous that there is scarcely any part of the tissue which is not filled with them. Towards the lumen of the intestine, the bacilli are contained in the necrotic tissue where it touches the surface, and are also found immediately on the surface, and in some granular de-

tritus adhering to this. Toward the muscular coat, the bacilli were found in considerable numbers. The cells in the dilated lymphatics contain the tubercle bacilli in comparatively large numbers. These lymphatics are just above the muscular coat.

The most interesting of the intestinal lesions with regard to the bacilli are given in the sections of the vermiform appendix. There are immense numbers of bacilli in the true follicular tissue, both in the necrotic foci and where the cells are normal. There are large numbers of epitheloid cells just above and in the muscular coat. In the muscular coat they are chiefly around the blood-vessels, and appear as a hyperplasia of the surrounding lymphatic sheath. There are also cell groups in the sub-mucosa which can be recognized as lymphatic vessels filled with epitheloid cells. In all these places the bacilli are in large numbers, both in and between the cells.

In the mesenteric lymph-glands the condition is very much the same as in the intestine. All of the areas of necrosis in the gland contain them in such numbers that the tissue has a red tinge under the low power. The bacilli are also found in smaller numbers in the tissue of the gland everywhere, sometimes enclosed in the large cells.

This case is of interest from the character of the process, and the enormous number of bacilli present. There can be little doubt that the infection is primary in the intestine. The conditions of the tissues must have been most favorable for the growth of the tubercle bacilli. Neither macroscopically nor microscopically was the condition one which could certainly have been regarded as tuberculous without the evidence of the bacilli. There was no formation of tuberculous tissue either in the miliary or diffuse form in the intestine or lymph-glands. No giant cells were present. The process, both in the intestine and in the lymph-glands, was an acute hyperplasia of the lymphoid tissue, with necrosis, inflammatory exudation, and leucocytes. The process microscopically is more similar to typhoid fever than to tuberculosis, although the large epitheloid cells of the typhoid are absent. The involvement of the lymphatic

vessels in the process and the numbers of bacilli in them explain the extent of the process in the mesenteric glands and the rapidity of its development.

Case II. — W. J. S. *Anatomical diagnosis:* Disseminated tuberculosis of lungs, with rapid softening simulating abscess. Chronic interstitial nephritis. Chronic perisplenitis. Hypertrophy of left ventricle. Chronic endarteritis.

Body length 162 cm.; well developed, poorly nourished; muscles small; fat over abdomen 8 mm. in thickness. Rigor mortis marked. Slight lividity of dependent portions.

Heart. — Weight 280 gms. Valves normal. Left ventricle hypertrophied; ventricular wall from $1\frac{8}{10}$ cm. to $2\frac{4}{10}$ cm. in thickness. Slight thickening at base of aortic cusps.

Lungs. — Both firmly adherent to costal pleura by dense fibrous adhesions. On section, left lung shows considerable congestion and oedema, especially posteriorly. The upper lobe contains numerous small cavities filled with yellowish-gray, nearly fluid contents. The walls of these cavities are ragged, soft, and light gray in color. The lower lobe studded with great numbers of miliary tubercles. In the right upper lobe is a similar condition of a larger number of irregular cavities, two or three of which reached the size of marbles. It could not be positively determined whether these cavities were connected with the bronchi or not. The middle and lower lobes show miliary tubercles, and a few of the larger ones were softened. Not one of these tubercles shows any sign of caseation. After reaching a certain size, they all begin to soften in the centre.

Spleen. — Weight 110 gms. Capsule thickened and opaque. On section, splenic substance of good color; follicles and vessels distinct.

Kidneys. — Combined weight 170 gms. Small and numerous cysts beneath capsule; surface very irregular; capsule adherent. On section, cortex diminished from one-half to one-third of normal thickness. Gastro-intestinal tract normal.

Liver. — Weight 1250 gms. On section, normal.

Pancreas and adrenal glands. — Normal.

Aorta. — Slight thickening of intima just above the aortic valve, and also throughout its whole extent.

Sections were made from the lower lobe, embracing the more consolidated portions of the tissue, and through the miliary foci, after hardening in 80% alcohol. These sections were stained in various ways, both for the tissue and for bacteria.

The macroscopic examination of the slides shows partial and complete consolidation of the tissue. The consolidated areas vary in size; some are miliary, and others about 1 cm in diameter. The consolidated tissue appears to be surrounded by denser, though not solid, lung tissue.

Under a low power the relation of the pneumonic areas to the bronchi can be made out in most cases. The larger bronchi and those of medium size are often intact, with the epithelium in position. In general, the smaller masses are around terminal bronchi. On some sections the bronchus is seen opening into an alveolar passage, around which the tissue is solid. In some of the larger areas there are cavities with ragged, uneven walls. In one of the sections a bronchus partly filled with granular detritus is found opening into such a cavity. Where the bronchus passes into or through the pneumonic areas, although the epithelium may be elevated and mixed with detritus in the lumen, the bronchial wall seems little affected. Most of the areas of consolidation are formed by an intense purulent infiltration of the tissue, the pus cells being packed so closely that nothing of the lung tissue can be recognized. There is some fibrin among the pus cells, and a great deal of nuclear detritus, which results from the breaking down of the pus cells. Outside of the solid area of tissue there is purulent infiltration of the walls of the alveoli, with large numbers of cells in the alveoli themselves. The general cellular infiltration is chiefly composed of leucocytes, but among them there are a few large round cells with epitheloid nuclei. In some of the alveoli, where the cellular infiltration is not so marked, there is swelling and proliferation of the alveolar epithelium; the large round cells probably originating in this way. The

alveolar walls are thickened, and the blood-vessels often obliterated by hyaline thickening of the walls. The smallest nodules have, in general, the same character as the larger. They consist of areas of intense purulent infiltration, with necrosis of cells and tissue. In some places around these there is a well-marked fibrinous exudation in the alveoli, with but few pus cells in the fibrin. These smaller nodules, in most cases, appear to begin in the air cells and alveolar passages. Between these smaller nodules the alveoli are filled up with a granular, partly hyaline mass, in which there are numerous pus cells and large alveolar cells.

On the outside of the necrotic area, in some of the smallest nodules, there is a tissue similar to tuberculous tissue, with here and there a giant cell.

Sections stained for tubercle bacilli show these to be present in enormous numbers all through the tissue. They are most abundant in the areas of complete consolidation, and the granular material between the cells seems to be almost composed of them. Where most numerous they frequently have the same spiral arrangement in clumps which is seen in pure cultures. In the surrounding areas of purulent infiltration they are also present in large numbers, and are both within the pus cells and the large epitheloid cells. They are also found in the tissue, at a distance from the consolidation. Masses of them are occasionally seen in the granular material in the alveoli, and in the large cells both within the alveoli and in the walls.

Careful examination of the tissue for other organisms failed to reveal any. Here and there in the arteries, in the vicinity of the most advanced lesions, there is an acute endarteritis, with proliferation of the endothelium.

The process in the lung may be regarded as a purulent inflammation, with necrosis of cells and liquefaction of the tissue, resulting in the formation of cavities. Macroscopically the whole process is much more similar to abscess formation than to tuberculosis, and without the presence of the tubercle bacilli it would have been so regarded. It is evidently due to a flooding of the tissue with immense numbers of tubercle bacilli, entering by means of the bronchi.

These have not produced any bronchitis, but have passed down into the terminal bronchi and air passages of the lung and there produced not a formation of miliary tubercles or tuberculous tissue, but an actual suppuration of the lung. Only in a few places, and around the smallest nodules, is there any suggestion of tuberculous tissue. The process differs from the common type of tuberculous pneumonia in the fact that the lesions are almost entirely exudative in character. There is nothing of the smooth, firm consolidation ordinarily found in tuberculous pneumonia. The tissue becomes necrotic, with breaking down of cells into fragments and nuclear detritus, and without the fusion of cells into a homogeneous mass as in caseation.

ARTICLE III.

A STUDY OF FIVE CASES OF ACUTE GLOMERULO-NEPHRITIS, SHOWING THE CONNECTION BETWEEN THIS CONDITION AND INFECTION, AND ONE CASE OF SUB-ACUTE GLOMERULO-NEPHRITIS.

Case I. — J. C. *Anatomical diagnosis:* Aneurism of aorta, projecting into the pulmonary artery. Stenosis of pulmonary artery. Hypertrophy and dilatation of heart. Acute endocarditis. Acute glomerulo-nephritis. Acute splenic tumor.

Through the kindness of Dr. F. W. Draper, the heart, kidney, and spleen were turned over to the pathological department from a medico-legal autopsy which was made on account of sudden death from unknown cause.

There is general anasarca of entire body, pulmonary oedema, general chronic passive congestion of abdominal organs. The main interest centres in the heart and kidneys.

Heart. — Large; weight 700 gms.; both layers of pericardium smooth; over the right ventricle a few punctiform ecchymoses. The right auricle somewhat dilated. The tricuspid valve 14 cm. in circumference; the right ventricle dilated and hypertrophied; the wall 1 cm. in thickness. The endocardium of right heart pale; otherwise normal. The pulmonary valves soft, save for a very small fibrinous vege-

tation at the junction of middle valve with the wall. There is a large, smooth globular mass filling up sinus of left pulmonary valve and projecting in a flaccid condition 1½ cm. into artery. There are a very few vegetations on the edge of this where it joins the artery.

The left side of heart dilated. The left ventricle 2 cm. in thickness. The endocardium smooth. The myocardium somewhat soft. On aortic aspect of the mitral valve there is a small yellowish patch, and over the surface, close to the edge of the valve, there are minute granular elevations. The chordae tendiniae nearest to these vegetations are swollen, cloudy, and in some places the entire cord is converted into a rough granular mass. On the ventricular aspect only the edge of the valve is affected, and on this there are smooth globular elevations, filled with a clear fluid. These elevations seem to be formed by a driving up of the endocardium. The coronary arteries normal.

The aorta measures 9 cm. The aortic valves are covered by large, fresh, irregular vegetations. The surface of the aorta as far as seen is sclerotic. Immediately above the right coronary artery there is a dilatation about 1 cm. in extent and involving 2½ cm. of the artery. The wall of the artery at this point is thin and of a reddish color. Immediately adjoining this, and between the two coronary arteries, there is an opening, with smooth round edges, with an average diameter of 2 cm. This opening leads backward into an aneurismal cavity 3 cm. in depth, which projects backwards into the pericardium and into the pulmonary artery.

Kidneys. — Both kidneys greatly enlarged. Weight of both 600 gms. Capsule easily removed. Size 14×7×5 cm.

Right kidney: surface smooth in appearance, very slightly uneven to feel, general color pale, pinkish, with more opaque whitish portions. All over the surface there are small bright-red points; on section very sharp differentiation between cortex and pyramids. Markings of cortex obscure, with here and there paler opaque reddish masses. The freshly cut surface rather refractive. Malpighian bodies prominent, large, and pale.

The left kidney shows about the same condition as right, with exception of being paler. Haemorrhages are not so marked. Kidney fractures easily; test with iodine negative.

Spleen. — Large. Weight 330 gms. Smooth and pale. On section, comparatively firm. Malpighian bodies very prominent.

The cover-slip examinations from the edge of the valves show many lancet-shaped diplococci arranged in pairs, with slight staining of capsules. The cultures from spleen and kidneys sterile: those from the heart obscured by great numbers of contaminating colonies.

Sections of the kidney examined after hardening in Zenker's fluid.

There are no old lesions in the kidney. The tubules of the cortex are greatly dilated. Here and there in cortex there are foci of haemorrhage in the tubules. All of the tubules of the cortex, and to some extent the tubules of the pyramids also, are filled with a reticular-looking substance, which appears in the form of small circles in the tubules. It gives the impression of empty vesicles whose walls stain slightly. Along with this there is a greater or less amount of finely granular material. This material is present in the greatest amount in the convoluted tubules. The epithelium of these tubercles shows a greater or less degree of degeneration. The epithelium is low, extremely granular, and in places the cells are filled with hyaline globules. The striated border of the cells is visible at very few points. In places the cells are almost entirely removed from the tubules, and only fragments of them can be seen. These vesicular structures in the tubules in some places seem to be in connection with the cells. There is no increase in the nuclei of the cells, and no nuclei between the tubules. The space between the tubules in some places appears to be slightly increased.

The most of the small arteries of the kidneys show more or less extensive arterio-sclerosis, with considerable increase in the thickness of the intima. The glomeruli everywhere throughout the kidney are enlarged. They do not, in all

cases, completely fill up the capsule, leaving a space which is filled with the same sort of vesicular material which the tubules contain.

With high power there is, in places, an increase of the cells within the vessels. These cells have a single large vesicular nucleus, and a small amount of protoplasm about the nucleus. Among these cells there are a few poly-nuclear leucocytes. This increase in the cells is more striking in certain of the vessels than in others. Loops of the glomerulus are found which are completely filled with cells. Although among the cells some poly-nuclear leucocytes are found, the most of them, certainly, are not derived from the blood. In some places glomeruli are found in which the blood-vessels are thickened, hyaline, and, to a large extent, obliterated. In a few of the glomeruli there is some growth of the capsular epithelium, and in these glomeruli there are some areas of total necrosis and obliteration of the capillaries, the whole tissue at such a point being filled with hyaline masses which lie apparently within the vessels. There is less lobulation of the glomeruli than is usually found.

Sections of a portion of the mitral valve, embracing the free edge of valve and some of the chordae tendiniae, show extensive necrosis of both valves and cord, with purulent and fibrinous infiltration. In the purulent infiltration there are numbers of pus cells containing diplococci, and at the edge of the necrotic material there is a considerable amount of more ill-defined, partly diffusely-stained micrococci, in many of which the diplococcus form is seen.

Case II. — L. P. *Anatomical diagnosis:* Abscess of neck and of left axilla (streptococcus pyogenes). Hyperplastic glands of neck and of left axilla. Acute broncho-pneumonia, with oedema and hypostatic congestion. Chronic adhesive pleurisy. Slight ascites. Oedema of abdominal tissues. Acute glomerulo-nephritis.

Body rather small; emaciated. Mammary glands remarkably well developed; hard; very little fat tissue present. Bed-sore over sacrum, size of silver dollar; a similar one

over left hip. Scar under right jaw, with enlarged glands under it. About the middle of the neck, well over on the right side, is a broad pustule; on puncture a large amount of pus escaped, coming from a pocket beneath. In left axilla is a small sinus, discharging pus.

Heart. — Weight 245 gms. Valves and cavities normal: contains fluid and clotted blood.

Lungs. — Left lung oedematous; heavy; flabby. Pleura showed few fibrous patches; is covered, especially over upper lobe, by a thin layer of fibrin. On section, much serum and blood ooze out from surface. Here and there are small, light granular areas slightly elevated above the surrounding lung tissue.

Right lung adherent to costal pleura posteriorly, especially over the lower lobe, by fibrous adhesions. It shows, on section in the posterior parts, even more marked oedema and congestion than the left. The areas of broncho-pneumonia are fewer in number.

Spleen. — Weight 115 gms.; capsule thickened.

Kidneys. — Combined weight 510 gms.; large; capsule peeled off readily, leaving smooth surface. On section, cortex pale, broad, oedematous. Glomeruli not visible; markings not distinct. Test for amyloid negative.

Peritoneum contains about 200 c.c. of clear fluid. The mesentery and walls of intestines are all oedematous and thickened.

The gastro-intestinal tract shows no other lesions.

Bladder. — Normal.

Uterus. — Small. Ovaries small; corpus haemorrhagicum in the right ovary.

Liver. — Weight 1,200 gms.; pale; lobules distinct; peripheries pale.

Brain. — Weight of brain 1170 gms. Remarkable for the deep pigmentation of the pia over the upper cervical cord, the medulla, pons, optic commissure, and a portion of the adjoining cerebral convolutions.

Ear.—The examination of the ear was practically negative. The external meatus contained pus in each case, but no extensive middle-ear disease could be made out. Mastoid cells normal.

Neck. — On right side of neck, lying rather deeply, is an abscess cavity, size of hen's egg, opening externally at the pustule mentioned above. The surrounding lymph-glands and those beneath the jaw were hyperplastic and oedematous, but no evidence of tuberculosis can be found.

Examination of the pus shows numerous chains of streptococci. On the left side of neck were hyperplastic glands and small abscesses which had opened externally.

Examination of right knee joint and of lower end of femur is negative.

Bacteriological Examination.

Pus of neck, profuse growth of a short fine bacillus. Water of condensation. Numerous chains of streptococci.

Heart's blood; few colonies of streptococcus and one of aureus.

Liver: profuse growth of streptococcus.

Kidneys: sterile.

Spleen: Numerous small chains of streptococci from water of condensation.

Bacteriological Diagnosis.

General infection with streptococcus pyogenes.

Kidney. — Tubules of cortex are dilated. They are filled with the same reticular material as in the preceding case. This reticulum is not present, or to a very slight extent, in the tubules of the pyramids. The epithelium of the convoluted tubules is intensely granular. The striated border is indefinite. The edge of the epithelium is more regular than in the previous case. The glomeruli are swollen, usually filling up completely their capsules. In some places, the glomerular capsules contain the reticular material; in others, not. The cells of the glomeruli are increased. The capillaries in some cases entirely obliterated. Among these cells there are many leucocytes. There is some increase in the epithelium of the glomerulus also. There is no chronic process.

Case III. — A. L. *Anatomical diagnosis:* Acute ulcerative endocarditis of pulmonary valves, with destruction of

valves. Thrombus in sinus of Valsalva of pulmonary artery. Thrombus of left pulmonary artery. Bronchitis and broncho-pneumonia. Old and fresh tuberculosis of lungs, with cavity formation. Acute glomerulo-nephritis. Acute splenic tumor.

Body slightly built. Skin pale: marked oedema of the lower extremities. The abdomen slightly distended. On the left abdominal wall a large brown discoloration with sharp irregular edges.

The skull rather broad; symmetrical. The dura mater normal. The longitudinal and lateral sinuses contain pale clots. The pia slightly oedematous. The arteries hyperaemic and tortuous. Arteries at base of brain normal. The brain somewhat hyperaemic.

In the abdominal cavity much clear fluid. The subcutaneous tissue pale, fatty, yellowish. The muscles are of a good color. The lymph-glands of neck normal. The costal cartilage soft up to the first rib.

The left lung retracted. Firmly adherent by connective tissue adhesions. The pericardium wide: contains much yellowish fluid.

Heart large. On the interior surface of the right ventricle there is a small haemorrhagic spot. The mitral valve of ordinary width. Tricuspid wide. The right ventricle somewhat dilated. The muscle pale yellow. The dilatation is most marked at the conus arteriosus. The depth of the ventricle along the septum is $6\frac{1}{2}$ cm. In the place of the left pulmonary valves there is a projecting grayish membrane which, in its deepest portion, measures 3 mm. On the edge of this there are small vegetations. There is scarcely a trace to be seen on the right valve. Only on the anterior edge is there a small projection. Between these two valves there is a vegetation, 1 cm. long, of a firm, whitish character. The anterior valve shows the greatest change. On this edge is a vegetation, 1 cm. long, on its base and just as broad. This edge is covered with vegetations. Above this valve, in the sinus, there is a large, soft thrombus, the interior of which is filled with yellowish pus.

The left heart enlarged and dilated. The ventricle $1\frac{1}{2}$ to

2 cm. thick. Muscle pale. The aorta is small. The intima pale.

The left lung is large. At the apex some cicatricial thickening. The greater part of the lung contains air and is oedematous. The smaller bronchi of the lower lobes contain pus. In the larger bronchi there is only a trace of pus. The upper lobe of the lung is consolidated, and contains small cavities with smooth walls, which are connected with bronchi.

The right lung small. The whole somewhat pigmented. The posterior part is atelectatic. In the lower lobe, close beneath the pleura, there are numerous nodules of a grayish-red color, partially caseous, with cicatricial edges. The centres of these nodules are composed of a tolerably thick, dense tissue in which lung tissue can be made out. In the upper lobe the tissue is oedematous; and in this oedematous tissue there are smaller and larger firm masses, tolerably circumscribed. On section, these masses are composed of a quantity of small grayish nodules. There are small areas of firm consistency and smooth-cut surface around the bronchi.

In the pulmonary artery there is a large firm thrombus mass which partially fills the lumen of the artery. In the adjacent vessels there are fresh reddish thrombus masses.

Stomach, intestines, pancreas, and adrenal glands normal.

The spleen greatly enlarged. Weight 420 gms. On section, pale. The follicles, vessels, and trabeculae fairly distinct.

The combined weight of the kidneys is 460 gms. The capsule pulled off easily, leaving a smooth surface. This surface is pale, rather refractive, and mottled. On section, the cortex is pale, showing numerous yellowish patches and streaks. The glomeruli, for the most part, are visible, and appear as pale gray points.

Pyramids are moderately injected, and appear in sharp contrast to the cortex.

Liver weighs 1920 gms. On section, the lobules are somewhat injected. All other organs normal.

Bacteriological Examination.

Cover-slips from valvular vegetations and pus in thrombus in pulmonary orifice contain masses of pneumococci with well-marked capsules. Cultures from the blood of heart, from the areas of broncho-pneumonia in the lungs, from the liver, spleen, and kidneys, all show numerous colonies of pneumococci.

Preparations of the kidney, hardened both in Zenker's fluid and in 80% alcohol, were examined. With low power the preparations show throughout the cortex some dilatation of the tubules, with slight increase in the tissue between them. Here and there the increase in the intertubular tissue is more marked; in places it is entirely absent. It is in general more extensive in the region of the glomeruli than elsewhere. There is not a great deal of cellular increase in the intertubular tissue, although here and there are masses of round cells which are generally near the glomeruli. The condition of the tubules is best seen in preparations hardened in Zenker. The epithelium of the convoluted tubules is low and atrophied. The striated border is not well marked. The tubules are filled with a reticulum which appears to be formed of round globules, the contents of which have dropped out. In some of the tubules are well-marked hyaline casts: others are filled with granular material; and others again contain solid plugs of leucocytes. In some places there is a considerable haemorrhage in the tubules. The pyramid of the kidney shows some thickening of the intertubular tissue, and many of the tubules contain casts, or are filled with red blood corpuscles.

The glomeruli are enlarged; in most cases they completely fill the capsules, and the outline of the glomerulus is not so sharp because its cells seem to blend with the cells outside. With a low power the increase in the cells of the glomeruli is striking. In preparations hardened in Zenker in which the blood is preserved very few of the glomeruli contain blood. Only here and there single blood corpuscles are found in the small and atrophic capillaries. With high power the glomeruli show the general lesions of the intra-capillary glome-

rulitis. The increased number of cells seems to be almost entirely within the capillaries, although there are large numbers outside. These cells in some cases seem to form a reticulum, completely filling up the lumen of the vessel. In the less altered glomeruli this increase of cells is the only thing seen. The walls of the vessels are perfectly evident, and there is no increase in their thickness and no tissue between the capillaries. In other places the capillaries appear to be entirely occluded by cells, their walls are thickened, and the portion of the glomerulus so affected is converted into a cellular mass, in which very small spaces representing the original blood-vessels are seen. In some of these places there is a slight formation of nuclear detritus. In others the cells appear to undergo necrosis, and the whole tissue at this point is beginning to be converted into a more or less homogeneous hyaline mass, with cells or cellular detritus included in it. None of the glomeruli have fallen from their capsules in the process of hardening and preparation.

Sections of the heart were made through the purulent endocarditis, involving and just behind the pulmonary valve. This shows a purulent thrombus on the wall of the aorta, with very slight infiltration of the wall. Lower down in the specimen there was considerable purulent infiltration of the tissue, dilatation of the vessels, with collections of leucocytes. Some of the sections embracing a portion of the valve show this to be necrotic, infiltrated with leucocytes, and on either side of it purulent thrombi. In places, the fibrin of the thrombi has become perfectly hyaline. Sections of the valve, at this point, stained for organisms, failed to show their presence. In some places in the pus, and in the pus cells, there are small masses which stain a pale blue, and which possibly represent the capsules of degenerated pneumococci.

The portion of the tissue examined does not represent the acute ulcerative process. This was not cut, on account of the desirability of preserving the specimens for the museum.

Case IV. — J. M. *Anatomical diagnosis:* Acute ulcerative endocarditis, with purulent and fibrinous infiltration

of myocardium and haemorrhage into pericardium. Obliterative pericarditis. Heart hypertrophy and dilatation. Arterio-sclerosis. Hydrothorax. Anasarca. Chronic nephritis, with acute exacerbation of intra-capillary glomerulonephritis. Infarction of spleen and kidney.

The body emaciated. Oedema of ankles, extending almost to knee. Oedema of scrotum. Rigor mortis.

The peritoneum smooth. The mucous membrane of pharynx and larynx normal. Deep veins of neck congested.

The upper lobe of the left lung is adherent to pleura by old adhesions. The right lung free. In the apex of left lung a small amount of cicatricial tissue. Both lungs compressed by a large accumulation of fluid in each pleural cavity.

The pericardial cavity obliterated. Both layers firmly united. The parietal layer of the percardium adherent to lungs and to the mediastinum. Between the layers of the pericardium there is a dense mass of fibrinous and connective tissue, which varies from 2 to 4 cm. in various parts, and here and there in the midst of the fibrin there is a small amount of haemorrhage. Over the right auricle the haemorrhage in the pericardium is the most extensive.

On opening the heart, a thick mass is felt between the aortic valve and the wall of the right auricle. The thickness of this mass is about 3 cm. On section, the mass consists of dirty, reddish-gray, fibrinous-looking material, in places broken down. The blood clot fades into this broken-down mass, and through it a probe passes easily through a thickened mass of similar material lying behind what corresponds to the third aortic segment. There is a direct continuation through this broken-down material from the aortic valve to the pericardial cavity in the neighborhood of this blood clot. The aortic valve corresponding to the left coronary artery is almost completely transformed into the mass of discrete and confluent, more or less translucent, grayish granulations, varying in size from 1 to 2 mm. Similar granulations extend down into mitral segment below. The circumference of the aortic orifice is 8 cm. There is no distinct calcification. All along the edge of the mitral valve there

are grayish and red translucent granulations. The coronary arteries normal.

Liver. — Weight 1820 gms. On the surface of the right lobe there is an irregular, somewhat stellate depression in an area corresponding to the lace furrow. On section, some cicatricial tissue extends from this into the tissue everywhere.

The spleen weighs 370 gms. On section, it is moist, rather diffluent, grayish-red in color. Malpighian bodies well defined. There are three sharply defined yellowish areas, which on section contain dirty grayish, yellowish, more or less softened material.

Both kidneys weigh 160 gms. On section, they are somewhat opaque and grayish red. The cortex measures 8 cm. Consistency somewhat increased. Capsule not easily removed. Surface very smooth. In each kidney there are yellowish depressions, the largest being about 1 cm. across. On section, this corresponds to yellowish areas in cortex, extending down to pyramids.

Pancreas and adrenal glands normal.

Through the entire aorta there is a considerable degree of arterio-sclerosis.

Testicles normal.

Stomach and intestines normal.

The examination of the brain shows a slight oedema of meninges and brain substance.

Cultures from purulent infiltration in heart, from spleen, liver, and kidneys, show pure cultures of pneumococci.

Tissues for microscopic examination hardened in 80% alcohol. Specimens of heart stained with eosin and methylene blue. This section was made from the purulent infiltration immediately behind the valve. In some places in this, on the edge, there are some lime salts, probably the remains of some old calcification of the valve. The most of the mass is composed of necrotic tissue in the centre, with haemorrhage in the midst of the necrotic tissue, and on the outside of this there is an intense purulent infiltration. The section has at one place extended into the cardiac muscle, and in this there is the same purulent infiltration. All of the cells in the area of the purulent infiltration, with-

out exception, are polynuclear leucocytes. Some of them are much more swollen than others. Immense numbers of micrococci arranged in pairs are found in the tissue. These are most numerous on the edge and in the necrotic tissue. Few of them are contained in the pus cells, but everywhere throughout the tissue small groups which probably correspond to necrotic cells filled with them may be found. The cocci vary considerably in size. In some of them the lanceolate character can be distinctly recognized. Others are exceedingly thin, and appear almost as fine points.

Sections through the lung show a slight degree of emphysema, and in places some thickening of the tissue, with pigment cells in the alveoli. Distinct areas of acute inflammation of the lung are not present.

In the liver there is an extreme degree of chronic passive congestion, with much atrophy of the tissue around the central veins. No distinct foci of necrosis and no acute inflammation is evident.

The spleen shows acute swelling, with slight enlargement of the malpighian bodies. There is also some thickening of the trabecular tissue. The pulp contains a large amount of blood, with numerous large swollen cells. No bacteria evident on microscopic examination.

Sections of the kidney show in a few places near the cortex a slight increase of connective tissue, with cicatricial destruction of the glomeruli. There is no more of this than would ordinarily be found in the kidney of the adult. The tubules in the labyrinth of the kidney are somewhat dilated. The space between the tubules is increased. There is no general cellular infiltration. No increase in the cells between the tubules in the kidney, with the exception of a very slight increase around the shrunken glomeruli in the cortex. At various places in the cortex, groups of tubules are found dilated and filled with blood: the epithelium reduced to a small margin around them. The outer veins everywhere are filled with blood, but there is no general capillary injection. The pyramids of the kidney present no change, with the exception that some of the tubules are filled with blood, and there is a slight degree of dilatation of the inter-tubular

tissue. The glomeruli are also prominent. In most places they completely fill the capsules; in others there is a small amount of granular material in which red blood corpuscles are frequently found around the outside. At various places in the cortex, groups of tubules are found which stain diffusely blue with the methylene blue stain.

On examination of these with a high power the nuclei are found very feebly stained, and the tubule contains cast-off cells and granular detritus. Various degrees of degeneration of the inter-tubular epithelium is found. The large contour of the cells is lost; nothing can be seen of the striated border; and the dilated tubules contain a considerable amount of granular detritus. There seems to be a slight degree of typical hyaline degeneration of the tubules. The glomeruli are large; the cells greatly increased in number. None of these cells are leucocytes. The greatest increase seems to be in large, rather pale cells. The capillaries, in some cases, contain these cells within them. In some of the glomeruli the capillaries are apparently obliterated by the pressure of the cells. In others they are present.

The manner of hardening this kidney does not permit of so thorough a study of the relations of the glomeruli as is possible in some cases.

In one of the sections there is a fresh infarction, of anaemic character, of small extent. There is very little infiltration with leucocytes around the periphery of it: only at one point on one side of the infarction there are numerous leucocytes, with great swelling of the protoplasm. In some of these, diplococci similar to those in the heart, and rather faintly stained, are evident. No organisms are found in the glomeruli.

Case V. — J. L. *Anatomical diagnosis:* Erysipelas of face, head, and neck. Congestion and oedema of lungs; acute splenic tumor. Fatty degeneration of liver and myocardium. Acute glomerulo-nephritis.

Autopsy, four hours post mortem. No rigor mortis. Body large, with abundant fat development. Dependent portions of body congested. Face, neck, scalp, and clavic-

ular region deeply injected and purplish. Skin of face desquamated. Eyelids tightly adherent, with purulent exudation in conjunctivae. Bloody crusts on each eyelid. Peritoneum free from fluid; smooth. Mesenteric and omental fat very abundant. Pericardium contains a few c.c. of clear fluid. Great congestion of large venous vessels.

Heart weighs 290 gms. Myocardium rather pale and flabby; coronary arteries show yellowish patches, but no occlusion. In ascending aorta, some arterio-sclerosis. On mitral valve, slight thickening, no retraction. Cavities of heart normal size.

Lungs. — Both lungs more or less adherent by old adhesions, which are easily broken down. Pleura otherwise smooth. Pleurae contain very small amount of fluid. Apex of left lung is slightly puckered; a hard nodule evident in tissue. On section, upper lobe of lung pale. On pressure, a small amount of frothy fluid exudes. Lower lobe shows areas of congestion and oedema. The nodule at the apex shows itself to be an old tuberculous fatty calcified area, surrounded by indurated fibrous tissue. In the right lung, congestion and oedema, especially in the lower posterior portions.

Liver. — Large. Weight 2000 gms. Gall-bladder distended, and contains several gall-stones, the largest 1 cm. in diameter. On section, the lower lobes visible; consistency somewhat increased.

Spleen. — Large; firmly adherent to surrounding tissue by old adhesions. Weight 280 gms.; soft, almost diffluent. On section, pulpy; dark red. Malpighian bodies enlarged. Adrenal glands and pancreas show no change.

Kidneys. — Large; combined weight 430 gms. imbedded in large amount of fat. Capsule easily stripped off. Surface smooth, of a general grayish-red color, with small opaque areas and small foci of ecchymosis. On section, cortex pale grayish-red color, with small round and linear red points and whitish opaque foci. These very pale opaque foci seem to correspond to convoluted tubules. The tissue moister than normal. Consistency about normal.

Ureters and vessels. — Normal.

Bladder. — Contains a small amount of pale, rather viscid, fluid.

The uterus contains several (up to 5 cm. in diameter) firm myomata imbedded in muscular tissue, and in the cavity two small polypi.

Stomach and intestines. — Normal.

Bacteriological Examination.

Cultures from the congested areas in lungs gave a profuse growth of streptococci. In liver, kidneys, and spleen, no streptococci; only a few colonies of accidental organisms.

Microscopic examination of the kidneys was made, after hardening in corrosive. The blood is beautifully preserved. With low power the tubules are dilated; many of them filled with red blood corpuscles. The epithelium of the convoluted tubules is greatly swollen. In part there is simply an increase in the size of the cells, which are more granular: in part the swollen cells fill up, almost entirely, the lumen of the tubules. In places, the nuclei have disappeared, and the cells are filled with hyaline globules. In addition to the red blood cells, the tubules contain large numbers of leucocytes, and fibrin. Among the leucocytes in the tubules there are a number of lymphoid cells. The space between the tubules is dilated, and contains a finely granular or hyaline material. In some places, this finely granular material is in spaces with definite walls, probably dilated lymphatics. The glomeruli are greatly enlarged. In some cases, however, they do not completely fill the capsule, but between the capsule and glomerulus there is a space filled with more or less granular reticulum. The glomeruli are usually conspicuous in the absence of blood, which is very apparent in the rest of the tissue from its bright stain with eosin. The number of nuclei in the glomeruli is in all cases far in excess of the number of red blood corpuscles. In some of the glomeruli no red blood corpuscles are apparent. Examination of the glomeruli, with a high-power immersion, shows in part that the blood-vessels are dilated. These dilated blood-vessels show little or no change in their walls. There are many of them packed full of polynuclear leuco-

cytes, among which, here and there, a brightly stained red blood corpuscle is evident. In other places, the blood-vessels are filled with a more or less granular and hyaline mass, in which, here and there, cell forms can be recognized. This is often combined with a hyaline thickening of the walls of the vessel, which, with the hyaline formation within, converts small portions of the glomerulus into hyaline masses. In other places the occlusion of the vessels seems to take place in great part from hyaline thickening of the wall. In the increased size of the glomerulus, large masses of it are sometimes found extending into the efferent tubule. The epithelium on the surface of the glomerulus, and the epithelium of the tubules, show no proliferation. The leucocytes are found in comparative abundance in the capsular space, and there is little doubt that they come from emigration of those within the glomerular capillaries, for there is no leucocytic infiltration of the surrounding connective tissue. The source of the blood within the tubules is not evident. It certainly does not come from the haemorrhage from the glomeruli, because a very few red corpuscles are found in their vicinity. In some of the glomeruli, comparatively large masses of hyaline necrotic tissue are found.

This case is one of acute glomerulo-nephritis following erysipelas. The interest of the case is largely in the fact of the participation of the leucocytes in the process. It has been generally denied that emigration takes place from the vessels of the glomeruli, but in this case it seems evident that the leucocytes in the tubules, as well as those in the capsular space of the glomerulus, could have had no other origin.

The case is of further interest in the large amount of fibrin which is found in the tubules. This fibrin in some places has the ordinary fibrillar appearance. In others it is converted into coarse hyaline masses. In such cases it cannot be distinguished from the hyaline masses, which evidently result from the degeneration of the capsular epithelium.

Case VI. — J. O. *Anatomical diagnosis:* Ascites. Sub-acute glomerulo-nephritis. Hydrothorax. Acute splenic tumor.

Body length 165 cm. Skin of a delicate, almost marble, white. The legs and scrotum very oedematous. Abdominal cavity contains a moderate amount of light yellow fluid. In right pleural cavity, a considerable amount of serous fluid. Right lung: lower lobe somewhat compressed. Both lungs oedematous.

Heart. — Weight 220 gms. Myocardium pale, valves normal.

Liver. — Surface smooth, pale. Weight 1100 gms. Gall-bladder normal. Lymphatics on surface of liver are dilated.

Spleen. — A little softer than usual. On section, dark reddish-brown, and studded with numerous pin-head sized, grayish, round areas. No increase of pulp. Weight 150 gms.

Kidneys. — Combined weight 350 gms. Capsule stripped off easily, leaving a smooth surface. The surface pale, with slight pinkish mottling. Cortex is pale, opaque, with small opaque almost whitish areas. The markings obscure; the glomeruli enlarged, appearing as pale points, more projecting than normally. Width of cortex 8 mm. The pyramids of a bright red color.

Bladder. — Filled with whitish cloudy urine.

Stomach, pancreas, and intestines. — Normal.

Mesenteric glands. — Somewhat enlarged.

Histological Examination.

Fresh frozen sections of kidneys show extensive fatty degeneration of the convoluted tubules, especially marked, in foci corresponding to the paler opaque foci seen on section.

Sections of the kidney were made after hardening in corrosive. There is a considerable atrophy of the cortex. The spaces between the glomeruli are greatly lessened. The inter-tubular tissue is greatly increased. The convoluted tubules are very small; the epithelium is low, atrophic, and resembles the epithelium of the collecting tubules. The formation of the connective tissue is diffuse, affecting all portions of the kidney almost equally. In some places in the inter-tubular tissue there are large numbers of cells of lymphoid character. In places in the connective tissue be-

tween the tubules, remnants of the tubules in the shape of scattered epithelial cells are evident.

The study of the glomeruli shows interesting relations. With a low power it is seen that none of the glomeruli have gone on to complete atrophy. All seem to be equally affected. The most obvious thing with the low power is the enlargement and the lobulation of the glomeruli. They completely fill the space around them. They are close together, owing to the atrophy of the intervening tissue, and the most of them are divided into definite lobules. With a high power the cells in the glomerulus are enormously increased in numbers. The vessels are not visible at all, or reduced to very small spaces in the midst of the cells. The cells have the general character of granulation cells, and they appear to be rather between than in the vessels. In places, the cells and vessels are converted into more or less hyaline masses. In other places, in the more solid portions of the glomerulus, a definite striation is apparent. The epithelium of the glomerulus seems to take no part at all in the process. The cells covering the vessels are either absent or show no proliferation. Around the glomerulus, in the capsule, there is an evident change in some cases, in others none. In some, just outside of the mass of vessels, a large number of cells may be found. These cells have the general character of epithelium. They often form masses extending in between the lobules of the glomerulus. In other cases there is, along with this cell formation, an evident participation of the fibrous wall. Rows of cells, also of an epitheloid character, may be found in the wall, separated from those within the capsule by a band of connective tissue. The cells in the capsule sometimes are around definite spaces, which space may communicate with the capsular space of the glomerulus. Here and there the fibrous tissue of the wall extends definitely into the glomerulus, and melts with its tissue. In these places it is possible, in most cases, to trace vessels going into the glomerulus, and probably anastomosing with its prominent vessels, although no such anastomosing was definitely seen.

The first five of these cases are interesting in showing the

form of nephritis which most usually supervenes on an acute infection. Three of them followed acute ulcerative endocarditis due to infection with pneumococci. The two other cases were due to streptococcus infection, one following an abscess of neck, due to streptococci, and the other erysipelas. In all of these, the chief lesions are found in the glomeruli. These lesions, in all, consist of an increase in the cells of the glomeruli, with, in some cases, a slight participation of the cells of the capsule in the process. In all there are extensive degenerations in the convoluted tubules which consist in necrosis, granular, and hyaline degeneration.

The fifth case differs materially from the others in the participation of leucocytes in the process. In this kidney the changes are more distinctly inflammatory than in the others. Polynuclear leucocytes are found in great numbers in the capillaries of the glomeruli and in the capsular space into which they have come from the glomerular vessels. This condition is not often seen in the acute intra-capillary glomerulitis, and the emigration of leucocytes from the capillaries of the glomeruli has been denied by some authors. Large numbers of leucocytes are also found in the tubules, which were very probably derived from the glomeruli. It is possible that the fibrin in the tubules also has the same origin.

The sixth case is a typical example of the medium-sized white kidney, and in this, also, the changes are distinctly glomerular in character. The changes here consist in atrophy of the glomerulus by hyaline degeneration. It is a type of nephritis which represents a chronic condition of the preceding forms. The atrophy of the glomerulus is due to hyaline degeneration of the cells which fill up the capillaries, probably with thickening of the capillary walls. As far as could be learned from the history of the patient, the disease had come on suddenly, six months before his death. It is very probable that here, also, the beginning of the process was in an acute infection. Our experience has been that the acute glomerulo-nephritis is an infectious process which is more often due to the pneumococcus than to any other organism, and is most common in the endocarditis due to this organism. The renal lesions do not appear to be the

result of the direct action of the pneumococci on the tissues. They are diffuse, and are probably due to the action of chemical products. In most of the cases no organisms are found on microscopic examination or on cultures of the kidney.

ARTICLE IV.

CYST FORMATION IN URETER.

J. A. N. *Anatomical diagnosis:* Chronic diffuse nephritis. Hypertrophy and dilatation of heart. Thrombosis of left ventricle. Embolus of pulmonary artery. Infarction of lung. Gangrenous softening of infarction. Oedema of lung. Chronic passive congestion. Hypertrophy of prostate; hypertrophy of bladder; acute cystitis, ureteritis, and pyelonephritis. *Cysts in ureter.*

Body length 152 cm.; muscular. The lower half of right leg has been amputated, the stump cicatrized.

Heart. — Weight 470 gms. All the cavities are dilated, especially the right auricle, which projects in striking manner. The walls of both ventricles are thickened. The right side of heart contains no thrombi. The valves fairly normal. The coronary arteries greatly thickened. The lumen of the right coronary artery just beyond origin so diminished that a probe 1 mm. diameter will not pass through it. The left ventricle at the apex contains 3 or 4 pea or almond sized soft reddish-gray thrombi, adherent to wall.

Aorta. — Dilated. Numerous yellowish elevations of intima. Just above bifurcation there are several small light red ulcers, containing a soft, putty-like material. The iliac arteries dilated, the intima calcified.

The intima of femoral artery on this side of the amputation is very much thickened, and the artery in Hunter's canal contains a light brown thrombus which is firmly attached to vessel wall.

Lungs. — Right pleural cavity obliterated by fibrous adhesions. Left pleural cavity contains 200 cc. of yellow serum. Both lungs hyperaemic and oedematous in lower posterior portions. In the lower lobe of the left lung there

is a large wedge-shaped red infarction. In the centre of this there is a small irregular cavity filled with stinking material. There is a red embolus in a branch of the pulmonary artery at the apex of the infarction.

Liver. — Weight 1220 gms. Consistency somewhat firmer than usual. On section, typical nutmeg marking. Gall-bladder and bile-ducts normal.

Spleen. — Weight 90 gms. The consistency firmer than usual. On section, dark red. Malpighian bodies obscure.

Kidneys. — Weight of kidneys 225 gms. Both of same size and smaller than normal. The capsules easily removed; the surface hyperaemic and finely granular. On section, cortex grayish, markings obscure, and in both are small foci of purulent infiltration.

Bladder. — Somewhat dilated; its walls hypertrophied. The mucous membrane thickened and hyperaemic: numerous diverticulae between the thickened trabeculae of muscle. In places there are small haemorrhages with slight necrosis of the surface. The prostate greatly enlarged. The lateral halves 5 cm. in diameter. The third lobe projects as a solid more or less isolated mass into the bladder, divided into two projecting portions by the urethra, which makes a channel between them. On the projecting third lobe of the prostate there are two distinct grayish sloughs. The ureters on both sides are dilated, the walls thickened, the mucous membrane intensely hyperaemic, granular, and covered with small cystic dilatation, with thin walls, and filled with clear contents. Here and there in the ureters there are small areas of necrosis. In both kidneys the pelvis dilated, the mucous membrane thickened and gangrenous.

Adrenal glands and pancreas. — Normal.

Stomach and intestines. — Normal.

Urethra and testicles. — Normal.

Bacteriological Examination.

Cultures on blood serum from substance of left lung contain numerous colonies of the pneumococcus.

Tubes from blood of heart, liver, and kidney contain a

profuse growth of the colon bacillus. Tube from spleen sterile.

Cover-slip from pus contains numerous bacilli, often in the pus cells. These did not grow in cultures or were obscured by the colon bacilli.

Sections of the ureter embracing the small cysts were made after hardening in alcohol.

Examination shows that the ureter contains numerous cysts of smaller and larger size. The largest of the cysts seen in the section are 1 mm. in diameter. These larger cysts are immediately beneath the epithelium. The cyst wall is separated from the lumen by the thinnest possible layer of connective tissue. The larger cysts are lined with flattened epithelium. They are filled with granular material evidently resulting from the coagulation of their contents. The smaller cysts are lined with a definite layer of cylindrical epithelial cells: in some cases there is a double layer of these present. The blood-vessels of the ureter are greatly dilated, and filled with blood. In the tissue of the wall there is a considerable number of leucocytes, with some increase in the cells of the tissue. In addition to these cysts there are small masses of epithelial tissue in the shape of long glands, with a very small lumen which communicates with the surface of the ureter. There is a slight dilatation of the lumen in the lower part of some of these glands.

This case is of interest from the rarity of these small cysts of the ureter. They were described by Morgagni and Rokitansky. Virchow placed them among the retention cysts, and thinks that they develop not from true glands, but from crypts of the mucous membrane. The presence of glands in the ureter has been generally denied, but the observations of Hambenger and Von Brems have shown that true glands are irregularly distributed over the upper portion of the ureter. The cysts are usually confined to this portion of the ureter, and are associated with chronic inflammatory conditions. They vary in size from those just visible up to 1 cm. in diameter. In a case reported by Litten, the entire upper third of the ureter was so filled with these cysts that they produced partial occlusion of the ureter, with following

hydro-nephrosis. Recently attention has been again directed to them by the articles of Bland Sutton, Jackson, Clark, and Von Kahlden, who have referred them to a parasitic origin, and described bodies belonging to the protozoa in their contents. In this case careful examination failed to reveal such bodies, and there seemed no reason why they should not be regarded as simple cystic dilatation of the glands. The presence of true glands in the same sections with beginning dilatation in some of them confirms this idea of their origin. It is possible that such glands in the mucous membrane of the ureter vary in frequency in different individuals.

XXIII.

ADENO-CARCINOMA OF THE PANCREAS, PRODUCING MULTIPLE STRICTURES OF THE INTESTINES.

By James Homer Wright, M.D.

Clinical History. — T. B., aged fifty-six, a bar-tender, entered the Boston City Hospital, May 31, 1895, in the service of Dr. Sumner, and was later transferred to the service of Dr. Post. At the time of admission the patient complained of abdominal pain, vomiting, and constipation. His family history was negative.

Personal History. — For several years the patient has suffered from indigestion and constipation, together with abdominal pain of a sharp, lancinating character. On account of the pain he took paregoric, and formed a habit for the drug, which he stopped about three months previous to entrance. At that time he was taking about two ounces a day. He has been losing flesh for about three months. During the past six weeks there have been no movements of the bowels except after injections of olive oil. The food has been vomited almost immediately after ingestion. The vomitus has never contained blood or fecal matter. There is no history of alcoholism or venereal disease.

Physical Examination. — Patient moderately well developed and nourished. Face anxious, with expression of pain. Eyes rather sunken.

Abdomen. — Much distended. Girth 36¾ inches. On inspection, the peristaltic movements of the intestines can be seen, while a rumbling and gurgling noise can be heard. Area of stomach tympany seems to be largely increased. Distention of abdomen apparently gaseous. No well-marked tumor felt, but a sense of resistance is encountered

just above the umbilicus. Attempts at deep palpation cause pain and great peristaltic activity.

Examination per Rectum. — About as high up as the finger can reach there is felt a marked thickening and constriction of the rectal wall, barely admitting the tip of the finger.

The margins of this constricted portion have a rough, cauliflower feel.

On removing finger, about an ounce of thick, tenacious mucoid material flowed out, resembling in appearance and consistency the white of egg.

Heart, *Lungs*, and *Liver* negative.

Spleen. — Area obscured by tympany.

Urine. — Slight trace of albumen, some mucus, and an occasional leucocyte.

Temperature normal.

Washings of stomach, on microscopical examination, show a few red blood-cells, but no evidence of malignant disease of the organ.

The diagnosis of *cancer of the rectum* was made, and the case transferred to the service of Dr. Post for operation.

Operation by Dr. Post, June 4; ether anaesthesia.

On account of the friability of the tissue of the stricture, dilatation was not attempted, but an ileo-colotomy decided upon.

Incision, eight centimetres long, parallel to Poupart's ligament, left side, about two inches above and to inner side of it.

Upper end of wound somewhat above the anterior superior spine of the ileum.

On opening the peritoneal cavity, some clear fluid escaped, and the small intestine was found markedly distended.

The large intestine, however, was found completely collapsed. It was apparent, therefore, that the distention of the intestine was not due to the stricture of the rectum; but that the obstruction must be above the portions of the large gut which were exposed to view.

A loop of the distended small intestine was then sewed to

the abdominal wound, and the gut opened to relieve tension, a fecal fistula being formed. The patient recovered from the operation, and did fairly well until June 14, ten days after the operation, when vomiting appeared, and considerable pain was felt.

These continued, the patient growing steadily weaker, with subnormal temperature, until June 20, when he died.

Autopsy. — Seven hours post mortem.

Anatomical Diagnosis. — Ileo-colotomy, fecal fistula. General fibrinous peritonitis. Streptococcus septicaemia.

Adeno-carcinoma of pancreas, involving, by direct extension, the mesentery, the rectum, the colon, the ileum, and the jejunum.

Obstructive carcinomatous stricture of jejunum, with dilatation, hypertrophy, and stercoraceous ulceration of the intestine above it.

Carcinomatous stricture and ulceration of rectum. Senile degeneration of kidneys. Chronic pleuritis.

An abstract of the protocol is as follows:

The body is that of a white man, past middle life, of slender build and medium height. Muscles moderately well developed. No scars on penis. Subcutaneous fat small in amount. In left iliac region there is a lineal wound, about six centimetres long, closed by sutures. No fluid in peritoneal cavity. The ileum is adherent to the abdominal wound, about an opening in its wall, which a later dissection showed to be about two metres below the pylorus. The intestines weakly adherent by fresh exudation, and along margins of contact the vessels of the serosa are congested.

The mesentery is much thicker than normal, dense, and hard to the touch, and, on section, of a tough, fibrous consistency and appearance.

Near its root, this fibrous thickening of the mesentery becomes much more marked, and is intimately associated with the tissue of the pancreas about the head of that organ.

The stomach shows a very much elongated pyloric end, but is not otherwise remarkable.

The duodenum is rather long, but shows nothing worthy of note.

The jejunum, for a distance of about three metres below the duodenum, is of much greater circumference than the rest of the small intestine. The serous coat shows here and there ill-defined, slightly elevated, circular, colorless nodules, varying in diameter from one to three millimetres.

Along the mesenteric border tough thickenings of the mesentery may be made out, which are accompanied by more or less puckering of the gut wall. Where the dilatation of the jejunum ends, at about three metres below the duodenum, there is a more extensive area of thickening of the mesenteric attachment, which is of a dense fibrous character, and which produces a stricture of the gut, clearly accounting for the dilatation of the intestine above. There is no ulceration of the mucosa over the constricted portion.

The mucous membrane of the dilated jejunum is dark red in color, in places, and here and there presents shallow ulcerations.

The remainder of the small intestine below the stricture is small in calibre, pale in color, and in two or three places other dense fibrous thickenings in the mesenteric insertion, with more or less puckering of the intestinal wall, are to be seen; while in the caput coli there is a similar fibrous thickening, with some puckering. No ulcerations of the mucosa were observed in connection with these fibrous thickenings.

In the rectum, about nine centimetres from the anus, there is a dense area of thickening in a portion of the rectal wall, with superficial ulceration of the mucous membrane over an area of about the size of a quarter dollar. This thickened area of the rectal wall, on section, is translucent, grayish, and rather fibrous in appearance. About nine centimetres higher up there is another thickened area in the wall of the rectum, but there is no ulceration.

The *retro-peritoneal lymph-glands* not enlarged. The *pancreas* is intimately associated about its head with the dense fibrous tissue of the mesentery. The duct is dilated, but the organ is not otherwise remarkable.

There were no evidences of metastases in the various organs.

The *bacteriological examination* by cultures on coagulated blood serum showed the presence of the streptococcus in large numbers in the spleen, liver, and blood of the heart. A few colonies of this organism also developed in the culture made from the kidney.

The microscopical examination of sections of the pancreas, mesentery, and intestinal wall, hardened in alcohol and stained with haematoxylin and eosin, gave the following results:

Margin of the Head of the Pancreas, with adjacent fibrous Mesenteric Tissue. — Among the tubules of the pancreas, islands or solid masses of cells, much larger in diameter than the pancreatic tubules, are seen, whose component cells have the general character and appearance of pancreatic epithelium. The adjacent thickened mesenteric tissue contains fairly numerous tubules of variable diameter, lined with a moderately high epithelium, and rather widely separated from one another by a dense connective tissue stroma.

These tubules sometimes show evidence of branching. The epithelium lining them is for the most part in a single layer, but in some instances masses of epithelial cells of an irregular polygonal outline may be seen, more or less filling up the lumen of the tubule. There is no evidence of mucoid degeneration of the cells of these tubules, and in their general appearance there was nothing to indicate that they were derived from any other tissue than the pancreas.

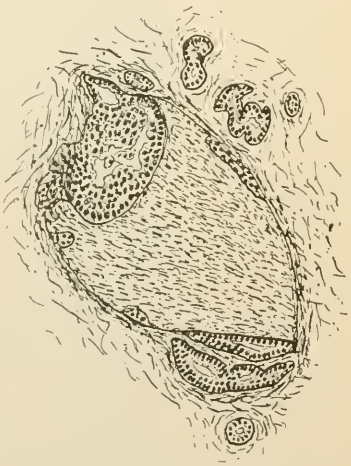

FIG. 1. — Nerve of mesentery, showing invasion of its sheath by the growth. Isolated cancerous tubules in the neighboring thickened connective tissue of the mesentery.

Mesentery. — Sections at various places show a great development of fibrous tissue, in which are seen rather

widely scattered tubules of variable diameter, lined for the most part with a layer of regular low epithelial cells. In several places these tubules have invaded the sheaths of the nerves of the mesentery, and in one instance a large tubule, containing a mass of irregular epithelium, almost completely filling its lumen, is seen growing from the nerve sheath into the midst of the nerve fibres. See Fig. 1. The mesenteric lymphatic glands, which occur in the sections, show several isolated tubules in their substance, but nothing more.

Section of the Small Intestine with thickened Mesenteric Attachment. — See Fig. 2. The mesentry at its attachment shows numerous irregular columns and masses of atypical epithelial cells lying in a dense fibrous stroma.

The cell masses are sometimes composed of many cells and sometimes of small groups of cells. In some cases the smaller groups have the appearance of irregular large multinuclear cells, imbedded in fibrous tissue.

The cells found in this portion of the section are very atypical and irregular in outline, generally having much protoplasm and often large vesicular nuclei.

The muscular coat of the intestine shows definite tubules lined with a fairly regular columnar epithelium, and apparently growing in the lymph spaces between the muscle bundles.

About the beginning of the sub-mucosa, these tubules often widen out into cyst-like dilatations, containing loose masses of large irregular epithelial cells.

The sub-mucosa is thickened, and shows numerous large spaces incompletely lined with epithelium and containing loose masses of atypical epithelial cells, of irregular form.

The spaces seem to press upon the *muscularis mucosa* and to have displaced it towards the mucosa. Besides these structures, the sub-mucosa is thickly infiltrated with larger and smaller masses of irregular atypical epithelial cells. In places these cells lie singly or in small groups in the meshes of the fibrous tissue.

The mucosa shows no evidence of ulceration. In one or two places, in the section, a tubule is seen in the mucosa whose lining cells, and general appearance show that it is

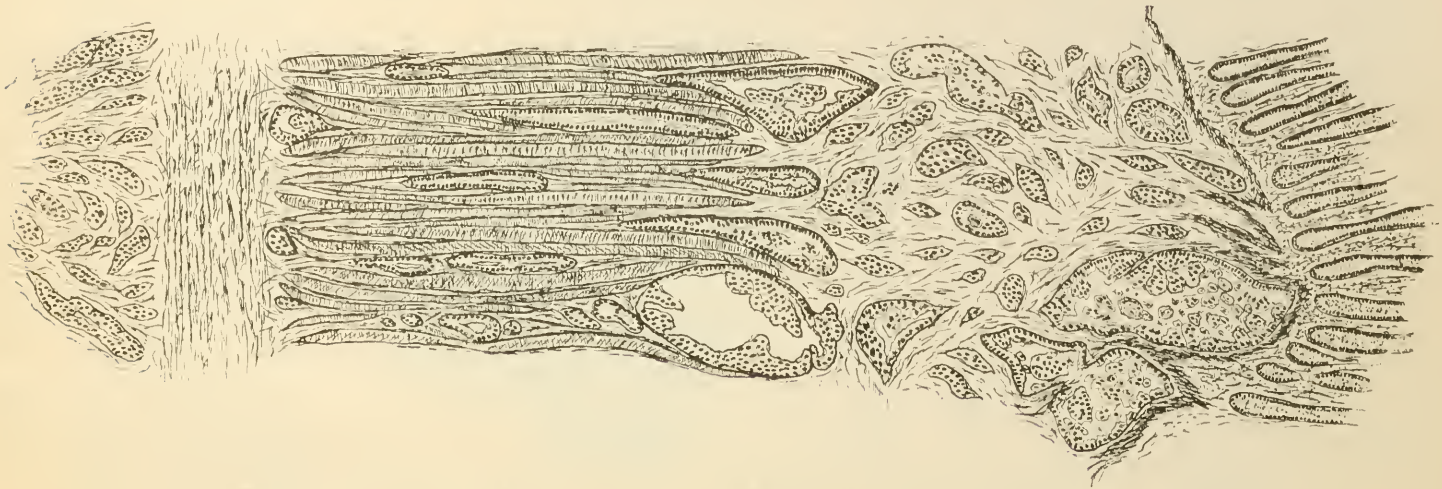

Fig. 2. — Section of constricted small intestine, showing the growth infiltrating the mesenteric attachment, muscle coat and sub-mucosa.

of the same character as the structures seen in the sub-mucosa and not an intestinal gland, but the involvement of this portion of the gut seems to be insignificant.

In the *rectum* essentially the same condition of the rectal wall is seen as in the small intestine. See Fig. 3.

The sub-mucosa presents large indefinite sinuses, more or less completely lined with a cubical epithelium, and contain-

FIG. 3. — Section of rectum, showing the ulcerated mucosa and the infiltrated sub-mucosa.

ing in their interior loose masses of irregular epithelial cells.

Small groups and larger masses of epithelial cells are also seen thickly infiltrating the fibrous tissue of the part. The muscular coats show also an invasion of the lymphatic spaces by epithelial structures.

In the mucosa some evidence of ulceration is apparent. The glands of the mucosa have almost completely disappeared, and in their places are seen atypical tubules, whose cells and general appearance indicate that they are of the same nature as the structures in the sub-mucosa, and which are markedly different from the few remaining rectal glands scattered among them. In one place a large, irregularly dilated tubule, lined with columnar epithelium, and contain-

ing loose epithelial cells, can be seen passing through the muscularis mucosa. See Fig. 3. Where it passes through, a distinct constriction is apparent.

Other sections of the intestinal wall, at thickened portions of the mesenteric attachment, show the same invasion of the intestinal coats, with a growth of the same character as above described. In none of these was the mucosa invaded to any extent.

In all the sections of the intestine, in places where the cells appeared most atypical, cells enclosed in larger cells are frequent. These seem to represent the parasites which have been described, by many observers, as present in cancer cells.

The few small nodules in the peritoneal coat of the jejunum, noted in the protocol, are seen to consist of connective tissue, containing in its meshes a very few tubules lined with a low epithelium. From a study of the sections and the gross appearances, the conclusion has been reached that the growth is an adeno-carcinoma of the pancreas, infiltrating by direct extension the lymph spaces of the mesentery, and invading the intestinal wall at various places.

The chief reasons for considering the pancreas as the point of origin are the following:

1st. The occurrence, in and about the pancreas, of atypical epithelial structures, and the close association of that organ with the thickened and indurated mesentery.

2d. The general character of the cells and tubules of which the growth is composed, these being unlike those of a growth originating in the alimentary canal.

3d. The infiltration of the intestinal wall at different points widely separated.

4th. The fact that the mucosa seems to be the last of the intestinal coats to be invaded, the impression produced by the general appearance of the carcinomatous structures being that of an invasion of the intestinal wall from the serosa rather than from the mucosa.